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The Recent Period of Slackness

Two or three months ago there settled down on this country an atmosphere of gloom and depression, the effects of which are felt even in these brightening and more cheerful days, when every industry appears to be feeling the stimulus of large orders and new hope. But back in October and November things looked pretty bad, for nobody wanted or dared to buy anything he could do without, and current statistics have shown how wretchedly dull trade was. The exports of electrical apparatus, which up to that time had been gaining by notable strides, fell off also, it appears, so that the figures of November, 1913, were not quite equal to those of the corresponding month in 1912. The total for the month in 1913 was only $2,243,460, as compared with $2,270,553 in 1912, thus exhibiting the first decline, though very slight, in many months. It is certainly curious how sympathetic one branch of an industry can be with another, but it is a fact that electrical export trade is rarely active unless domestic conditions are equally prosperous. Here is certainly an example of it, for electrical men were in general feeling blue last November, and many of them have scarcely yet recovered their equanimity. However, this year all are looking for better times and offsetting continued despondency by a determined effort to "ring them in."

Tone-Wheel Radio-Telegraph Detector

The tendency of radio-telegraphic sending stations on shore for long-range transmission is toward the production of sustained forced oscillations in the sending-mast wire, such as may be produced by a high frequency alternating-current generator, in contradistinction to wave-trains of damped free oscillations, such as accompany ordinary spark discharges. The received signals are therefore sustained alternating-current impulses in the receiving-mast wire. Such signals, if taken through a telephone, are not directly detected, because the frequency is necessarily inaudibly high. Fessenden was the first to make such signals audible in the receiving telephone, by using an alternating current, slightly out of synchronism, in a local receiving circuit and creating differential low-frequency or beat tones in the telephone, by interference between the incoming high-frequency tones and the local high-frequency tones. By this means an incoming frequency of 50,000 cycles per second can produce telephone signals of say 1000 cycles per second, that is, in musical tones near the most sensitive part of the ear's range, to the suppression of atmospheric and other similar disturbances. In the Digest in this issue is described a variation of this frequency-reducing process devised by Mr. Rudolf Goldschmidt. A high-frequency commutator is driven at the receiving station, slightly out of synchronism with the incoming signals, in such a manner as to produce differential low-frequency tones in the telephone, free from ordinary atmospheric disturbance. The commutator is actually a toothed wheel, like a Fizeau disk, driven at a high peripheral velocity, so as to be slightly out of synchronism with the incoming waves. By this means the usual rectifier is rendered unnecessary. Although the relative simplicity of spark radio-telegraphy will probably enable it to hold its place on board seagoing stations, it would seem that in the development of radio-telegraph engineering long-range shore stations will employ machinery at both the sending and the receiving plants.

Glare in Illumination

Of late no small amount of attention has been devoted to the bad effects of glare in illumination, and a committee of the Illuminating Engineering Society is preparing to deal actively with the subject. Glare has been described rather aptly as "light out of place," on the same principle that dirt is "matter out of place," but there are other considerations than this to determine glare in the condemnatory sense in which the word is generally used. The quantitative relations of the subject are usually entirely forgotten or misunderstood. The point to which attention should be particularly directed in any investigations on glare is that at which the phenomenon begins to be troublesome under ordinary circumstances. It is probably quite impossible, for instance, to secure a paper which will give perfect diffusion, but, on the other hand, it is very easy indeed to obtain paper good enough to reduce the trouble from specular reflection to a quantity which is practically negligible. In a similar way nothing is more exasperating than the glare of an unshielded arc lamp well within the field of view and a few yards off. The same lamp in the same part of the field a couple of blocks away is not in the slightest degree disturbing to the normal eye. Indeed, it takes some little experience to tell at that distance whether the lamp is equipped with a diffusing globe or not. Likewise the question of direction is relative and not absolute. A sufficient quantity of light may become very annoying although its angular position in the field be such that were it trivial in amount no one would pay any attention to it. It is these quantitative relations of things that we wish to impress on the people who are working with

the best of intentions toward improving the conditions of illumination. And, incidentally, we should like to suggest, very gently and with due deference to those possessed of a sensitive epidermis, that no discussion more readily lends itself to commercial axe-grinding than the discussion of glare. Any pronouncements on the matter should be very judiciously made lest they should appear in large caps, not to say as scare-head lines, for advertising purposes only. The public seldom realizes the quantitative value of things, and when these are important should be made to realize them as quickly as it does the qualitative values. By all means, let us work toward the reduction of glare, but first let us find out from a practical standpoint what is really to be desired.

Transmission at Constant Current

Our readers will welcome the account of recent advances in long-distance transmission by the constant-current system to be found elsewhere in our columns. The scheme is so foreign to our usual practice that it has hardly received even respectful attention from American engineers, yet it is perfectly obvious from the facts here exhibited that it is not only operative but possesses certain very characteristic advantages which are conspicuous in some classes of transmission work. An admirable example of a situation in which constant-current transmission proved desirable is its recent introduction for supplying energy for lighting and motor service in London and its environs. Here the supply corporation had to cover a very large and rather thickly settled territory with underground distribution involving an extent of cable which certainly would have represented a formidable undertaking for high-voltage constant-potential work. Instead of being a system of distribution as too commonly imagined, the Thury system is really one which finds its best application in large transmission work in which, particularly if underground, difficulties with regard to the line multiply as the distance is increased and the voltage raised.

For instance, on Jan. 3 and 10, 1914, we published an account of the Big Creek three-phase system for transmitting energy at 150,000 volts 240 miles into the city of Los Angeles. In order to maintain the intended pressure of 150,000 volts at each end of the line, use will be made of two 12,300-kva synchronous condensers running idle from the system. The requirement of the two synchronous machines of this outfit to insure proper voltage regulation is evidence enough that three-phase transmission systems have reached a point of development at which factors ordinarily of modest import become somewhat formidable. Fancy the situation if one were attempting to work a line of similar length with underground cables at any voltage for which cables have yet been manufactured. It was the recognition of this state of affairs that led to so serious a consideration of the Thury system for the long-distance project for several years contemplated for the supply of energy to Paris from the upper waters of the Rhone.

Similarly the switchboard construction in three-phase work has become very burdensome. One of the triple oil switches in the great California plant just referred to, for example, occupies 1200 cu. ft. and weighs 14 tons, including the oil filling. The series constant-current transmission requires practically no switchboard at all and the machines are put into and out of action with barely more than a turn of the wrist and in an astonishingly short time. In reckoning, then, upon the undeniably high cost of the commutator machines one must remember that the comparison should include not only the generators but the switchboard at the generating stations, and at the substations one may fairly compare the motor-generators and their switching apparatus with the transformers of the three-phase system plus their high-voltage switches, and perhaps an equipment of synchronous converters together with apparatus for their control. Taking all these things into consideration, the difference in cost for the two kinds of equipment becomes very much less than would at first seem likely, even with an overhead line. With a project for the line underground a very serious addition would have to be considered in the relative cost of the cables for the two systems for which exact data are not yet available. While no conservative engineer would be prepared to abandon our customary methods of transmission in an outburst of enthusiasm for something relatively new, yet it is evident that the constant-current system is one which must at times be considered with due seriousness as an economical possibility.

The Silver Voltameter

Certain ancient philosophers, in giving graphical form to their ideas on cosmogony, used to represent the world as carried on the back of an elephant, who, in his turn, rested his feet on the back of a large tortoise. There the sequence ended, and no one seemed to be perturbed as to the lack of a suitable substructure for the tortoise. Subsequent discoveries in gravitation, with the changes in philosophical opinion resulting therefrom, rendered the question superfluous by relegating both tortoise and elephant to the limbo of exhausted expedients.

The modern electromagnetic system of units, and with it the whole structure of electrical engineering, as well as the world-wide industrial superstructure of electric energy distribution, all rest upon Ohm's law, which is an experimentally observed relation between voltage, resistance and current in any simple closed circuit. In the international system of electrical unit standards defined by the Chicago congress of 1893, and built into the laws of most civilized countries since that time, the international ohm, volt and ampere were each and all concretely specified. The whole system of international electrical standards was thus ordained to

depend upon three fundamental standards—the international ohm, volt and ampere. From these the coulomb, the henry, the joule, the watt, the watt-hour and various other secondary units of the electrical industry could be regularly derived, so that the electrical universe of practical quantitative relations was legislated to rest, tripod fashion, on three tortoises in parallel. But, from Ohm's law, there being given any of the specified standards among the three quantities, resistance, voltage and current, the third is immediately deducible, Consequently only two of the three fundamental tortoises are really needed to support the superstructure, the third being merely thrown in for auxiliary purposes, as a sort of reserve pedestal for the edifice.

At first, the extra tortoise gave no trouble, and merely provided an additional facility in establishing electrical standards, until demands came for increased precision. It was then discovered that small but distinct discrepancies arose in the laboratory electrical standards of different countries, according to whether these were prepared from the international ohm and volt or from the international ohm and ampere; that is, as to which pair of the three fundamental tortoises was selected. In order to eliminate this source of discrepancy, the International Electrical Conference of 1908, in London, agreed to select the ohm and ampere as fundamental specified standards, thus reducing the number of fundamental tortoises from three to two, the volt being derived by a gentlemen's agreement from the other two and no longer being independently established. This procedure threw a considerable extra burden of importance and weight on the international ampere, as defined by the use of the silver voltameter.

As a result of the work of an international committee, conducted to a great extent in the Bureau of Standards at Washington, using the conventionally established electrochemical equivalent of silver as 1.11800 mg per international coulomb, it was decided to take the emf of the normal Weston cell, at 20 deg. C., as 1.0183 volts. This establishes the volt as a secondary standard, through the medium of the Weston cell, to five significant figures, and to a precision of the fourth order, which is amply sufficient for all ordinary engineering purposes.

Nevertheless, the Bureau of Standards has been steadily continuing its researches, with a view to determining one more digit and precision order, if possible, on the wise principle that the precision of comparison between fundamental standards in national laboratories should be one order greater than that needed in regular industrial calibration standards. The article by Messrs. Rosa, Vinal and McDaniel which we publish this week discusses the refinements that are necessary in the technique of the silver voltameter in order to arrive at uniform results of the fifth precision order. It is interesting to notice that a correction formula has been deduced for the influence of minute degrees of acidity in the silver-nitrate solution, and that porous pots are indicated as being preferable to porous envelopes of either paper or silk.

International Standardization of Machinery

The work of the International Electrotechnical Commission has hitherto been directed into two main channels, the standardization of terms and the standardization of ratings of machinery and apparatus, whereby a machine may have its output internationally defined. In a paper by Mr. A. R. Everest recently presented at Birmingham, England, and abstracted in *The Electrician*, it is pointed out that the I. E. C.was able to reach a satisfactory international agreement at Berlin last August upon the maximum temperatures that electrical machines should reveal under service conditions. This is a long step toward international standardization, and an advance over which all countries may well congratulate each other. Thus, it was agreed that the temperature observed in impregnated cotton coverings forming the insulation of machines up to 4 kv emf should not exceed 90 deg. C. at any time. It was not found possible to reach an agreement at Berlin as to what the international ambient temperature of reference should be, and perhaps it is just as well that agreement could not be reached, because it allows more time for careful consideration in all countries before coming to a decision.

Most of the countries represented at Berlin desired the international reference temperature to be 40 deg. C., which would mean that the international rating of such machines for continuous service should be that output which would ultimately effect a measured temperature elevation of 50 deg. A few countries, however, preferred 35 deg. C. for the reference ambient temperature, which would mean increasing the international rating to one that would effect a final temperature elevation of 55 deg. C. Mr. Everest points out that meteorological records taken in many countries situated within the temperate zones show at least occasional shade temperatures in the open air exceeding 35 deg. C. in the summer. If the outdoor temperature exceeds 35 deg. C., the indoor temperature of a dynamo room will certainly exceed 35 deg. at such times, unless expensive refrigeration is resorted to. This means that if the international rating were based on 55 deg. C rise, machines would exceed 90 deg. in their observed temperatures, at least occasionally during the year, at nearly all places in the temperate zones. On the other hand, if 40 deg. C. be taken as the reference temperature and the international rating on 50 deg., the derating of machines below the international value would rarely occur in the temperate zones, except where the dynamo rooms were hot and not easily ventilated. In other words, the international rating could be safely maintained all the year round, except in special cases. In winter the international rated output might often be exceeded at the owner's risk, but it is better to have a considerable margin of safety available in a machine for winter use, at the owner's risk, than to have to tell the owner that he cannot expect to carry the international-rating output during the summer. Let us hope that an agreement satisfactory to all countries can be reached at San Francisco in 1915.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Mechanical Refrigeration

Mr. J. B. Joyce, Jr., of the Public Service Electric Company, gave a talk on "Mechanical Refrigeration" in the company's Jersey City (N. J.) auditorium Feb. 6, pointing out that in some cases savings amounting to half the customer's ice bill have been made by the installation of motor-driven refrigerating outfits. In three or four years such a machine will therefore virtually pay for itself. Mechanical refrigeration insures cleanliness and a uniform degree of cold impossible with the use of ice. At the present time the Public Service Electric Company is testing a small refrigerating machine at its Newark laboratory. If the results of the experiment are satisfactory, the outfits will be put on the market for residence use.

Mining Engineers to Discuss Electrical Topics

At the convention of the American Institute of Mining Engineers to be held at New York, Feb. 16 to 19, a number of papers will be presented on electrical topics. On Tuesday afternoon the subject of electricity in mining will be discussed and the following papers will be read: "Use of Electricity at the Penn and Republic Iron Mines," by Messrs. William Kelly and F. H. Armstrong; "The Application of Electric Motors to Shovels," by Mr. H. W. Rogers; "Electric Traction in Mines," by Mr. Charles LeGrand; "Safeguarding the Use of Electricity in Mines," by Mr. H. H. Clark, and "The Safety of Underground Electrical Installations," by Mr. C. M. Means.

On Wednesday morning Mr. Albert Sauveur will read a paper on "Heating and Cooling Curves of Professor Carpenter's Electrolytic Iron," and on Wednesday afternoon Mr. Robert M. Keeney will present a paper on "Pig Steel from Ore in the Electric Furnace."

More Electric Trucks for Mail Service in New York City

The Postal Transfer Service, Inc., of New York City, has purchased twenty 2-ton General Vehicle electric trucks which will replace an equal number of gasoline trucks in the work of transferring mail matter between railroad stations, docks and post office substations in the district south of Forty-second Street. The Postal Transfer Service, Inc., of which Mr. H. Rowley is president and Mr. J. J. Cassidy is vice-president and operating head, was organized in the spring of 1913, and early in September the Post Office Department accepted the bid of this corporation for what is known officially as Route 407,012. Broadly speaking, this route involves the moving of all mail south of Forty-second Street, New York City. The service is divided into three classes—"mail-messenger" service between the general post office and railroad and steamship terminals; "transfer" service between depots, and "station" service between post office stations.

The firm started business with eighty 2-ton and twenty 1-ton gasoline trucks and will soon have 150 machines in all. The twenty electric trucks just purchased are to displace an equal number of gasoline trucks which have been put out of commission by the arduous service. The electric cars will be housed in the transfer company's own garage at Forty-second Street and First Avenue, New York.

The endurance of the electric vehicle under the peculiarly exacting conditions of metropolitan mail service has already been well demonstrated in the case of the Motor Delivery Company of New York (see *Electrical World*, Jan. 10, page 76). This company has had as many as twenty-eight electric cars in service since 1909. These machines in 1913 made 336,000 miles in 304 days. The Motor Delivery Company originally had the contract for what is known as the up-town section, extending north of Forty-second Street to 180th Street on the West Side, and to Fordham on the East Side. It hauled collections from one substation to another, and from these to the Times Square station. Since its inception the delivery company has used electric vehicles exclusively, and, as cited in the issue above mentioned, this firm at present has fourteen such machines engaged in parcel-post delivery alone.

Joint Meeting of Empire State Gas and Electric Association and Eastern New York Section, N. E. L. A.

A joint mid-winter meeting of the Empire State Gas and Electric Association and the Eastern New York Section of the National Electric Light Association was held at the Edison Club Hall, Schenectady, N. Y., on Feb. 6 and 7. Dr. William McClellan, of New York City, formerly connected with the Public Service Commission, Second District, spoke on "Various Matters Affecting Public Opinion with Respect to Gas and Electric Companies." Among the points brought out in his talk were the following: The desirability of maintaining intimate relations between the corporation and the public by keeping all of the officers in close personal contact with the patrons; the necessity of giving employees considerable leeway and responsibility to keep them interested in their work; the importance of training employees to secure and maintain the good will of patrons; the desirability of prompt and adequate settlement of complaints and the establishment of self-explanatory systems of rates, affording no opportunity of being classed as discriminatory, and the responsibility of corporations in fostering public welfare work and in clearing up public-utility questions brought before the legislatures.

A discussion ensued in which the following men took part: Messrs. H. W. Peck, James O. Carr, D. B. Rushmore and C. J. Witherwax, of Schenectady; T. H. Yawger, Rochester; A. R. Beal, Poughkeepsie, and A. D. Dudley, Syracuse.

Mr. C. W. Stone, of the General Electric Company, read a paper on the "Commercial Aspects of New Lamp Developments with a Retrospect as to the Effect of the Tungsten Lamp on Central-Station Revenue." The

advisability of central stations making lamp renewals was dealt with at length both in the paper and in the general discussion which followed.

Mr. C. H. B. Chapin, secretary of the association, made a report on the calorimeter situation. About 100 persons attended the meetings. Visits were made to the American Locomotive Works and to the General Electric Company's factory. A dinner was served at the Mohawk Golf Club, with Mr. R. M. Searle, of Rochester, past-president of the association, acting as toastmaster.

Government Investigating Electrical Jobbers' Association

Mr. George Carroll Parke, assistant to the Attorney-General, has set on foot in New York City an investigation of the affairs of the Electrical Jobbers' Association, based upon a complaint which came to the Department of Justice some time ago.

This statement was made to a representative of the *Electrical World* in Washington by Mr. Parke, who said he prefers for the present to withhold the exact details of the complaint.

"I have not as yet made any special study of the case, which is under my charge," Mr. Parke said, "and until the papers come back from New York I can say nothing about it, except that the complaint is of a routine nature, concerning the jobbers' association and having nothing to do with the electrical manufacturers, against whom, as I understand it, there has not been any complaint.

"We are not devoting any special attention to the matter in Washington. It was referred to New York for investigation. There may not be anything in the complaint, for all I know."

It is pointed out at the Department of Justice that complaints of all sorts are constantly being received, and that most of them are investigated in the usual routine of the office.

Co-operation Between Contractors and Fire Prevention Bureaus

Speaking before the regular weekly meeting of the Jovian Lunch League, St. Louis, on Feb. 3, Mr. Ernest McCleary, of Detroit, past-president of the National Electrical Contractors' Association, said that it is the duty of the contractor to co-operate not only with fire-prevention bureaus but with the jobbers and all others in the electrical business as well. To my mind, said Mr. McCleary, the jobber who distributes one piece of material which is below standard is a menace to the entire electrical industry. An accident caused by the failure of low-grade electrical material reflects upon the reputation of the central station, the manufacturer, the contractor and the local distributer. Only wholehearted co-operation of all of these interests with inspection departments of municipalities and of insurance companies can produce the general widespread results desired.

The code committee of the National Electrical Contractors' Association, of which Mr. McCleary has been an active member since 1902, has recently welcomed Mr. Franklin Overbagh, secretary of the Electrical Supply Jobbers' Association, to its ranks with the hope that the jobbers of the country will become more in sympathy with the work of the code committee. By the system of appeals which has been adopted by the code committee a dissatisfied contractor may appeal from a decision of an electrical inspector which he judges is unfair. These cases when filed with Mr. Ralph Sweetland, secretary of the electrical committee of the National Fire Protection Association, are considered and passed upon by the code committee and their decision when given becomes as binding as a code ruling. Five appeals have thus far been filed in 1914.

In a short discussion following the talk Mr. James H. Fenton asked whether a general feeling in favor of municipal inspection was prevalent among contractors where an inspection bureau was maintained by insurance interests. Mr. McCleary answered by saying that he did not favor municipal inspection.

Business Regulation, Competition and Price-Cutting

In a paper by Mr. Frederick P. Fish, former president of the American Telephone & Telegraph Company, presented before the second annual meeting of the Chamber of Commerce of the United States at Washington, D. C., Feb. 12, the regulatory effect of the Sherman anti-trust law was commented on in the following terms:

"Our modern business organization and business methods have developed automatically under the economic theory which so long prevailed, that in business there should be free play for individual intelligence, individual activity, individual initiative and individual effort. Every man was encouraged to build up as large an enterprise as he could, to get for himself as much trade as he could, and within the limits imposed by law and the principles of fair dealing was entirely free to exercise his ingenuity, intelligence and business skill by advertising, by organization, by adopting improved methods of manufacture and of sale and in every other way, so as to get and to do as large a business as possible. Other things being equal, the greater his success the more he was respected and the higher was the regard of the community for him. He who made two blades grow where one grew before was looked upon as a public benefactor. No one doubted that national prosperity and the prosperity of the people as a whole were promoted by securing and maintaining the utmost freedom of individual effort.

"But the Sherman law and all that has grown out of it illustrate an absolute reaction from this principle. Business men are no longer free, within the limits of honesty and fair dealing as generally understood, to work out their own salvation by strenuous enterprise and strenuous individual effort. They are hampered on every side by restrictions which a generation ago would have seemed inconceivably foolish and absolutely inconsistent with sound development.

"Even if the new view is correct, we should be very careful that it is not carried so far as to suppress individual effort and paralyze progress more than the public interest requires.

"It is a very serious thing to suppress individual enthusiasm. To force men not to work on the lines which the times themselves have established as those upon which alone great work can be done must lead to this result. Such a policy should surely not be adopted unless the loss is sure to be more than made up by gain in some other direction."

Concentration of Industry in the United States

In his discussion of the concentration of industry in the United States President Charles R. Van Hise of the University of Wisconsin, Madison, said that while the Sherman act has been useful in preventing unfair practices its most important effect up to the present time has been the acceleration of concentration of industry

by driving organizations from the trust to the holding corporation, and from the holding corporation to complete merger, an effect the very opposite of that intended by those who favored the passage of the law.

No advantage has been shown, he added, resulting from dissolution of public utility corporations under the Sherman act which are already under the control of the commissions, state and national. On the contrary, there is every likelihood that the public will suffer from dissolutions of organizations of this class.

President Van Hise therefore recommends that interstate and state trade commissions be created having powers in regard to those industrial organizations so large as to be affected with a public interest similar to those which the national and state utility commissions have in regard to the public utilities.

The Sherman act, he continued, should be supplemented by another act, forbidding all combinations and contracts in restraint of trade which are detrimental to the welfare of the people and making the presumption that all such combinations and contracts are thus detrimental, but permitting trade commissions to allow such reasonable contracts and combinations in restraint of trade as are not inimical to the welfare of the people.

Protection from Price Juggling

The dangerous effects of price-cutting and price-juggling were pointed out in a paper by Mr. William H. Ingersoll, of Robert H. Ingersoll & Brother, New York, which was read on Friday afternoon.

When a well-known article is sold at a cut price, said Mr. Ingersoll, the first effect is a stimulated demand, if the offer is bona fide. The second effect is that people are led to believe that they ought to get the goods regularly at the reduced price, and that those who charge more are exacting extortionate profits. The goods are cheapened in their estimation; they are no longer satisfied to pay former prices, so that the good will of the maker is seriously impaired. Other dealers in the community are unwilling to handle the goods at higher prices than are quoted elsewhere and in fact would have a very limited sale if they tried, and it would endanger their future patronage, so they find it better business policy to meet the cut price and close out the goods and not to carry them thereafter, or to carry very limited stocks, which are sold only upon urgent demand after the customer has declined the "something else" which the dealer, in the preservation of his very existence, finds it necessary to recommend, because even though it is unknown it pays him the necessary profit to meet his expenses.

In community after community these practices go on, and it might not be so bad if those who originally offered the goods at cut prices would continue them at the price and meet the demand for them. The sales, however, are sporadic, and the original cutter, after the sensation of the bargain offer has lost its pulling power, drops the goods and the market is lost to the maker through no fault of his own, and the goods are unavailable to the public conveniently and freely.

It is for these reasons that the manufacturers of the country are appealing for the recognition of their right to exercise control over the manner in which their own goods are sold after they have been intrusted to the market, and for the further and equally important reason that they see their smaller customers, who generally handle their merchandise fairly, being undermined and their own future market reduced to the fewer large retail institutions, which would then have them more fully in the latter's power.

Besides the ill effect of price cutting upon the goods, the trade and the public, one should not miss the point that these practices are not open to the small man, because he cannot advertise extensively, he cannot offer cut prices on one thing and recoup on other things, for his lines are limited and his capital small. Plainly such price cutting is an abuse for which some remedy must be found.

New York Requirements for Switchboard Wiring

In an effort to secure a standard interpretation of the switchboard wiring requirements contained in Rule 2-b, third and fourth paragraphs of the Electrical Code of the City of New York, the commissioner of water supply, gas and electricity has established the following ruling:

"Where a tight, non-combustible outer cover is required, compliance with Rule 2-b will be deemed to have been secured if asbestos tape is wound helically over the inflammable outer braiding, then wrapped with light twine or heavy pack thread and then painted with soluble glass, or if a braided asbestos tubing is drawn over the insulated wires and secured in place at the ends by means of twine or pack thread and then painted with soluble glass.

"It should be noted that in either case care must be taken to leave about 2 in. of the inflammable braiding free from this fireproofing covering at lugs and terminal connections, and also to keep the flameproofed wires away from all live metal parts."

Report of New York Conservation Commission

The third annual report of the State of New York Conservation Commission was sent to the Legislature recently. Mr. James W. Fleming, one of the commissioners, differs from his colleagues, Messrs. George E. Van Kennen and John D. Moore, on important questions of policy.

Mr. Fleming, in a memorandum in the report, states that he is in hearty accord with the general policy of conserving and utilizing the water-powers of the State, but he does not agree with his associates upon the plan of utilization and the places at which the policy shall be initiated. It is proposed to inaugurate the policy of generating electric current by the State by constructing power plants at Crescent and Vischer Ferry on the Mohawk River, operated by the surplus waters of that river, and its distribution to the municipalities in what is known as the Capital District. At these points and for many miles to the west the enlarged Erie Canal will be in the Mohawk River. It is conceded by all that during certain portions of the year there will be no surplus waters which could be used for power plants. Therefore auxiliary steam plants must be constructed and kept ready for use.

Mr. Fleming says that the future alone can demonstrate whether there will be surplus water sufficient in quantity and for sufficient length of time to make it worth while for the State to embark upon an expenditure of hundreds of thousands of dollars in the erection of power plants. It seems to him that the view of those who advocate the canal system and think that the installation of such plants on the theory of surplus waters in the canal would impair the navigation of the canal, or at least be a mistake until the canal is in actual operation, should receive the highest consideration.

Mr. Fleming adds that any one who will look at the Cohoes Falls and the Mohawk River during the dry seasons of the year, and particularly in years of drought, will be justified in entertaining very serious doubts whether there will be any surplus waters in the

Erie Canal at the time of the year when the greatest demand for navigation will be made upon that canal. If such should prove to be the case, it means that the auxiliary steam plant will be a very large, if not the principal, factor in creating and distributing the electric current. Mr. Fleming says he has yet to learn that the State can operate steam plants commercially with any special advantage to itself or to its citizens. His conclusion is that it would be the part of prudence to postpone embarking upon this enterprise until facts and experience shall show what waters are available at these points.

The general report of the commission declares that it is physically and economically practical to loop together the water-powers of the State by electrical conductors which, while serving practically every municipality, will be required to transmit electrical energy much less distances than other systems in daily operation. It adds that the State of New York must either develop its natural resources for the benefit of the many or else surrender them to be exploited by private monopoly for the enrichment of the few.

Recommendations for Water-Power Conservation in New York

The executive committee of the Empire State Gas & Electric Association, which is composed of seventy companies manufacturing and distributing electricity or gas or both in the principal cities and villages of New York State, has submitted to Governor Glynn a plan which it feels will accomplish the conservation of natural resources in the most satisfactory manner possible and with the greatest benefit to the State as a whole. Its conclusions are as follows:

1. The right to develop and use water-power now owned by the State or created by it in connection with the construction of any public works shall be leased in such a manner and at such prices as shall assure the State an adequate yearly revenue therefrom.

2. Such lease or grant shall in the first instance be for a definite period of sufficient length to warrant the investment of capital in the development.

3. At the expiration of such period the grant shall automatically become an "indeterminate" grant. That is, it "may be terminated by the proper authorities at any time upon the payment of a fair compensation for the value of the property thus taken," which shall include such appurtenances installed by the lessee as are necessary for the development of power.

4. At the expiration of the original term of the grant and at recurring intervals thereafter the amount of rental to be paid to the State, together with other necessary terms and conditions, shall automatically come up for determination.

5. A grant shall be unassignable except with the consent of the proper State authorities.

6. The grant shall be on condition of development of the whole capacity of the power site as rapidly as may from time to time be required with due consideration to market conditions and demands and also on condition that continuous power to the amount of the required development is available.

7. No person, corporation or municipality shall, in consideration of any contract or lease with the State under this plan, be relieved of any obligations now imposed upon it by law, and every person, corporation or municipality becoming a grantee under this plan shall, if the power is developed for sale, be subject to the jurisdiction of the Public Service Commission.

The committee maintains that the existing companies are the logical distributers for any power the State may have to dispose of, inasmuch as they have the distributing facilities and the steam reserve necessary for reliable service, so that no duplication of investment of any kind is required. These companies are, therefore, in a position to furnish the public with the best quality of service at the lowest possible cost, and the Public Service Commission law provides the means by which the consumers will benefit by any saving resulting from the purchase of power from the State by existing companies.

A. I. E. E. Midwinter Convention

The second annual midwinter convention of the American Institute of Electrical Engineers, which is to be held in the Engineering Societies Building, New York, Feb. 25 to 27, will be under the auspices of the electric-power committee, each of the six technical sessions being devoted to the subject of one of the latter's sub-committees. The convention will open Wednesday morning with an introductory address by President C. O. Mailloux, after which the following papers and reports will be presented: "Electric Power," by Messrs. D. B. Rushmore and E. A. Lof; sub-committee report, "Scope of the Engineering Data Sub-Committee," Mr. P. H. Thomas chairman; sub-committee report, "The Feasibility of an A. I. E. E. Handbook," Dr. Harold Pender chairman.

Power Station Session, Wednesday Afternoon.—"Protective Reactances in Large Power Stations," by Messrs. James Lyman, Allen M. Rossman and Leslie L. Perry; "Outdoor Versus Indoor Substations," by Mr. Alexander Macomber; "Indoor and Outdoor Substations in Pennsylvania," by Mr. H. L. Fullerton; "Outdoor Substations in New England," by Mr. Fred L. Hunt; "Outdoor Substations in the Middle West," by Mr. Leslie L. Perry, and "Suggestions for Discussion on Electrical Features of Power Station Design," by Mr. A. H. Kruesi.

Transmission Session, Thursday Morning.—Report of sub-committee, Mr. P. W. Sothman chairman; "Problems of High-Tension Transmission," with four appendixes: Appendix 1, "Deterioration of Porcelain Insulators in Service," by Mr. J. A. Brundige; Appendix 2, "Radius of Influence of a Direct Lightning Stroke," by Mr. L. C. Nicholson; Appendix 3, "Transmission-Line Problems in the West," by Mr. P. M. Downing; Appendix 4, "Switching," by Mr. G. Faccioli; "Practical Operation of Suspension Insulators," by Mr. H. W. Buck.

Power Generation Session, Thursday Afternoon.—"The Economical Capacity of a Combined Hydroelectric and Steam Power Plant," by Dr. C. T. Hutchinson.

Distribution Session, Friday Morning.—Report of sub-committee, Mr. P. Junkersfeld chairman; "Distribution of Electrical Energy," with nine appendixes: Appendix 1, "Three-Wire Direct-Current Distribution," by Mr. Philip Torchio; Appendix 2, "Alternating-Current Distribution," by Mr. H. B. Gear; Appendix 3, "Effect of Consumers' Apparatus and Wiring on Distribution," by Mr. H. Goodwin; Appendix 4, "Direct-Current Distribution for Surface Railways, Urban Service," by Mr. R. H. Rice; Appendix 5, "Direct-Current Distribution for Underground and Elevated Railways," by Mr. E. J. Blair; Appendix 6, "Direct-Current Distribution for Interurban and Steam Railroads," by Mr. W. G. Carlton; Appendix 7, "Alternating-Current Distribution for Interurban and Steam Railroads," by Mr. W. S. Murray; Appendix 8, "The Relations of Distribution Problems and Switching Equipment," by Mr. E. B. Merriam, and Appendix 9, "Distribution for

Street-Lighting Service," by Mr. Paul M. Lincoln.

Friday Afternoon, Protective-Apparatus Session.—"Recording Devices," by Dr. C. P. Steinmetz, and "High-Frequency Relays," by Mr. E. E. F. Creighton.

I. E. C. Dinner-Dance and Publicity Meeting

On Wednesday evening in the grand ballroom of the new Hotel Biltmore a dinner-dance will be held under the auspices of the Institute and the committee on organization of the International Electrical Congress, 1915. The purpose of this meeting is to enable members and the ladies of their families and other guests to meet and become informed of the plans for the San Francisco congress. During the dinner brief reports will be made on the organization of the congress.

On Thursday evening in the auditorium of the Engineering Societies Building there will be a general publicity meeting devoted to the coming electrical congress. Ladies are invited, and it is expected that the session will be of general as well as technical interest in connection with the congress, the exposition and the scenic and electrical features of the transcontinental journey. Following is the program for the evening: "The International Electrical Congress," by Dr. C. P. Steinmetz; "The Panama-Pacific International Exposition," by Dr. William Rader; "The Lighting of the Panama-Pacific International Exposition," by Mr. W. D'A. Ryan; "Scenic Features of a Trip to San Francisco," by Mr. James A. Cruikshank, and "Some Electrical Features of a Trip to San Francisco," by Mr. P. M. Lincoln.

Joint Meeting of Mechanical and Electrical Engineers in Philadelphia

The February meeting of the Philadelphia Sections of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, held on Feb. 9, was devoted to a discussion on the business training of the engineer. The principal speakers were President Alex C. Humphreys, of the Stevens Institute of Technology, and Mr. Theodore I. Jones, of the Brooklyn Edison company. The papers and the animated discussion which followed their presentation brought out two facts prominently—that the technical student must be taught that a knowledge of fundamental principles is only a means to an end, namely, their intelligent application to industrial conditions, and that in so applying them the foundation of success is sterling and uncompromising honesty.

President Humphreys devoted most of his paper to demonstrating the necessity for a knowledge of the principles of accountancy by the engineer. The engineer has too often fought shy of the business side of his problems and as a result has been unable to occupy an authoritative position when his solutions come to be tested by the ultimate standard of financial practicability. This is one reason why so few engineers are appointed on public service commissions. An engineer who assumes to guide an investor cannot avoid responsibility for the return on the investment, and no engineer who cannot check up estimates, made by himself or others, with the cost of carrying out the construction is competent to solve engineering problems. He cannot make such comparisons correctly for two reasons: First, he is likely to omit from them items of cost for which he assumes himself not responsible, either wholly or in part; second, he is not sufficiently familiar with the language of accountancy to be sure of the value of the comparisons made by others for him.

President Humphreys then proceeded to illustrate the need for a knowledge of accountancy in connection with estimates of depreciation, repairs, extensions and renewals, and with valuation work in general. He explained what he has been trying to do to meet the educational need in this direction.

Mr. Jones viewed the business training of the engineer from quite a different angle. He stated that engineers view business, and particularly salesmanship, with disdain, and yet it affords a most attractive and lucrative field for the engineer, who has not only his work but also his skill and analytical ability to sell.

The recital of the above fundamentals of the two papers does not indicate the causes of the lively discussion which was immediately precipitated. In fact, the discussion hinged on the connotation of the topics rather than upon the direct statements as outlined, with which all would agree. The discussion was opened by Prof. H. H. Norris, of the editorial staff of the *Electrical World*, who pointed out that students should be taught to avoid mechanical methods in study as well as in solving engineering problems. He was followed by Mr. Henry Hess, who struck the note which aroused a general and inspiring response that dominated all following discussion. This was the necessity for absolute honesty in all business and engineering dealings. There is no place for opportunism in this field. He made a clear distinction between the "designer" and the "engineer," holding that much of the confusion in the minds of the public regarding engineers is due to labeling as engineers men who are merely designers. The test is this, engineers hire designers, but never designers engineers. Mr. Walton Clark, of the United Gas Improvement Company, took up the cudgels for the technical graduates, who had on the whole been no disappointment to him. He echoed Mr. Hess' plea for honest work and urged that no school can hope to make an engineer or an accountant in the limited time available. Prof. George C. Hoadley, of Swarthmore College, protested vigorously against the prevailing habit of criticising college training as if colleges were not doing their work properly. Employers expect too much of young graduates and are largely responsible for the apparently prevalent criticism.

Thus one speaker after another, including Mr. W. C. L. Eglin, of the Philadelphia Electric Company, and others prominent in various fields of engineering, reiterated the fundamental principles cited at the beginning of this outline. So high was the ethical tone of the meeting that if the speakers had been ministers instead of lay preachers it could not have rung more true. In fact, the audience left with their best impulses stirred in a manner quite unusual in meetings of engineers, where the human element is sometimes submerged in the critical analysis of technicalities.

Factors Determining a Reasonable Charge for Service

Dean M. E. Cooley of the University of Michigan read a paper on "Factors Determining a Reasonable Charge for Public-Utility Service" at the annual meeting of the Western Society of Engineers in Chicago. Substantially the same address was made by Professor Cooley a short time before at a meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers. The author listed the several elements as follows:

I. Capital Investment.

1. Preliminary costs covering investigations as to feasibility of project. (Note.—Organization, promotion, administration and legal expenses, engineering

and superintendence during construction, which are distributed over the whole period of construction, are more conveniently placed further along in the schedule.)

2. The physical property, the several items making up the whole arranged in order, each with its proper allowances to cover contingencies, special engineering and other costs peculiar to the item; land first, followed by clearing and grubbing, then the various structures and equipment; sub-contractor's profits included with the separate items.

3. General contingencies applicable to the property as a whole as distinguished from special contingencies applicable to particular items.

4. General contractor's profits, or the profits to an engineering firm building the property on the "cost plus a percentage" plan.

5. General engineering and superintendence during construction.

6. Insurance and taxes.

7. Organization, administration and legal expenses.

8. Cost of promotion and promoter's profits.

9. Interest during the construction period.

10. Office furniture and fixtures.

11. Stores and supplies.

12. Working capital.

II. Operating Expenses.

13. Operating expenses *per se;* that is, salaries, wages, fuel and other supplies, repairs and upkeep; all expenditures required in rendering the service of the utility, including insurance and taxes.

14. Interest on the capital investment (the actual cost of the property); i. e., interest on securities which must be paid regularly.

15. Interest on floating debt. This may include the discount on bonds and the cost of financing, if these have not been incorporated with the capital.

16. Cost of establishing the business; the sums of money required to be borrowed, with interest on the same, to make good the differences between the earnings and expenditures up to the time the earnings become sufficient to meet all expenditures. This may be made a capital charge or carried as a floating debt to be paid out of future earnings.

III. Depreciation Fund.

17. The regular contribution to the depreciation fund, out of which the integrity of the property is to be maintained.

IV. Sinking Fund.

18. The annuity required to retire such portion of the securities as may be necessary at the expiration of the franchise life of the property, in order that the investor may receive back his entire principal when the business is closed out.

Professor Cooley said that an examination of the various percentages mentioned in discussing the elements of cost, omitting items 1, 4, 8, 15 and 16, will disclose that if the individual contingencies of construction, special engineering charges and contractor's profits be assumed to be embraced in item 2, the total percentage of overhead charge may vary from 12 per cent to 25 per cent; and if these inside percentages be added to the outside, or general, percentages, the total percentage may vary from 30 per cent to as much as 60 per cent.

The speaker expressed his regret that engineers and others who have had experience in building properties and valuing them afterward have not done more toward disseminating knowledge of the actual conditions found in such work. Engineers have hesitated many times to use the larger percentages, fearing to be accused of favoring the corporation. They have preferred instead to secure the equivalent of them by using larger units of costs, or have used the smaller percentages, influenced by the feeling, unconsciously perhaps, that, all things considered, the results were fair enough. In combining the judicial with their engineering function, they have unwittingly only obscured the issue. All too frequently engineers have felt obliged to exert themselves to the utmost in favor of their client, leaving the interests of the other side to be fought for with equal solicitude by an opposing engineer. Thus they have become advocates. This is not the best way to handle these momentous problems. It would be far better in these troublesome times to throw open the blinds and let in all the light possible, the motto which should be adopted being, *Veritas vincat.*

Public Service Commission News

Maryland Commission

An appeal from the order of the Maryland Public Service Commission fixing schedules for the Edison Electric Illuminating Company of Cumberland, Md., has been filed in Circuit Court No. 2 by the company through its attorneys, Messrs. W. Calvin Chestnut, James A. McHenry and Benjamin A. Richmond. Judge Ambler signed an order granting an injunction to restrain the carrying out of the Public Service Commission's order, with leave to the commission to move to have the injunction rescinded by giving five days' notice. The Edison Electric Illuminating Company of Cumberland was incorporated in 1884. It furnishes electrical energy and operates a steam-heating system in Cumberland. On June 18, 1912, the company filed with the commission a new schedule of rates, effective June 30. On July 1 a number of residents of Cumberland followed with a petition alleging that the rates were unfair and asking for an investigation. The result was finally that the Public Service Commission fixed a schedule from which the electric company is now appealing.

Whether electrical energy for moving-picture shows comes under the schedule of "power" or "light" is a question that has been up for decision before the Public Service Commission of New Hampshire, and the Maryland Commission was recently asked to give an opinion on the subject. After a consultation with the officials of the Consolidated Gas, Electric Light & Power Company, the commission wrote to the New Hampshire officials that energy furnished Baltimore moving-picture houses is looked upon as "power" in arranging classifications for rates.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has granted the application of the Phillipsburg Light, Heat & Power Company for approval of a franchise to operate at Phillipsburg, which territory is now served by the Eastern Pennsylvania Power Company of New Jersey. In approving a franchise to a competing company the board emphasizes the fact that any company furnishing inadequate or improper service will not be protected in the territory it serves, holding that the Eastern Pennsylvania did not furnish proper service. In its decision the board also cites an objection to an ordinance which requires a company to furnish certain public service without charge. The board is not satisfied that it has not the power to rescind such conditions should such be shown to be unjust and unreasonable. In this case the board, while not eliminating such provisions from the franchise, places the town on record as to taking the risk of their possible annulment by the courts or later by the board.

New Hampshire Commission

The Public Service Commission has denied the petition of the Grafton County Electric Light & Power Company for authority to issue $300,000 stock and bonds to purchase the central stations doing business in Lebanon and Hanover, N. H., and Hartford, Vt. The board points out that the properties to be merged under the petition are capitalized for $113,000 and states that the profits which would accrue to individuals from the transaction must come ultimately from the public, the proposition being inimical to the public welfare, in the board's opinion.

The commission was scheduled to give a hearing this week on the expediency of 4-cent fares on the Manchester Traction, Light & Power Company's lines, in accordance with a recent statute ordering the board to investigate the physical value of the property, the cost of operation and revenues derived from trolley service.

Nevada Commission

An explanatory statement has been issued by Mr. H. F. Bartine, chief commissioner, and Mr. W. H. Simmons, associate commissioner, constituting the majority of the Nevada Public Service Commission, in regard to the Ely Light & Power Company case. This case was mentioned in the *Electrical World* of Dec. 20, 1913, page 1254. The statement says that the minority dissenting opinion contains, in the judgment of the majority, errors both in figuring and in reasoning that are well calculated to mislead and convey a false impression of the merits of the case, as well as of the propriety of the action of the majority in modifying the original order.

The order was modified solely because further investigation disclosed the fact that the original order would have reduced the earnings of the company to the very line of confiscation if not actually crossing it. The explanation states that in the proceedings based on the original complaint by the city of Ely practically no testimony was offered going into the question of the excessive character of the rates as a whole. There was almost no attendance at the hearing and not a single witness was placed upon the stand to give testimony going directly and specifically to the point of the alleged excessive character of the rates. In reaching its original conclusion that the rates were excessive, the commission was compelled to draw its own deductions from the testimony, which went chiefly to the question of discrimination, together with the official records of the commission and the investigations of its own engineer. The result of the hearing was the elimination of the class "A" rate, which was the chief cause for complaint, and a heavy reduction in the "B" rate.

A subsequent investigation through an informal hearing disclosed the fact that the rates as prescribed would leave the company practically nothing in the way of net return. Suit had been brought by the company in court and the enforcement of the order had been restrained. It was obvious to the majority of the commission that, upon the showing as made, the court in Nevada would not sustain the order. Therefore the order was modified. The majority "fully recognized the fact that they owe a solemn duty to the public, but that duty carries us no farther than to see to it that justice is done to the public without injustice to the corporation."

The figures of earnings show the following net return on the value determined for the property in the last three years: In 1911, 7.35 per cent; 1912, 13.72 per cent; 1913, 13.41 per cent; average for the three-year period, 11.4 per cent. At the prescribed schedules of rate in 1913 the return would be 8.8 per cent. The majority opinion took $57,000 as the value of the property engaged in the service. This was the engineer's estimate of what it would have cost to reproduce it new. The dissenting opinion took present value, $41,000. The majority referred to the decision of the United States Supreme Court in the Minnesota rate cases, declaring that the court nowhere lays down the rule that in the actual work of rate-making the body which is invested with such power must consider only the depreciated value. It does not follow that when such a body makes a reduction in rates it must cut to the very lowest point at which the rates as prescribed would be sustained by a court. As a general rule the rates as prescribed might be made still lower and still be upheld by the court in which the validity of the order was contested. When there are no strictly legal questions involved, a court will hold that an order reducing rates is void only when the point of confiscation is reached. The reason why public service commissions usually stop considerably short of a confiscatory point is that investors are not as a rule willing to engage in business projects of any kind with the prospect before them of just barely escaping confiscation at the hands of a public service commission.

The majority thinks that it is not sound doctrine to hold that a public-service corporation shall be tied down to the construction of a plant no larger than is actually needed for the service immediately to be performed Every company has the right to look into the future and provide for increased business which seems reasonably in prospect. Some years ago the company constructed in the city of East Ely what is known as the "new plant," at a cost of $162,000. This was done because of the belief that Ely was destined to become in the near future another Butte. The majority still adheres to the opinion that the comparatively small population of Ely should not be made to bear the burden of the mistakes of the company arising from the fact that the district did not develop in accordance with the prevailing popular expectation. Nevertheless, as a matter of equity, the majority thinks that this matter should receive some consideration. The company had invested altogether $242,000 in its electric-light and power plants in the district. It claimed that the old plant alone, which is now serving the people of Ely and vicinity, actually cost $80,000. As stated, this valuation was cut by the engineer of the commission to $57,000.

The majority realizes that if it is too drastic in its action, if the cuts are made too deep and public service corporations are left with less than a fair return upon their investment and less than a fair compensation for the service rendered, which is also an element to be considered, it is more than probable that any court in which the case is tried will hold the order void. In such a case the commission suffers in prestige and loses the confidence of the court, which expects a commission to act in a spirit of absolute fairness.

The majority also considers the matter in the light of public policy. No state needs the introduction of capital for the development of resources more than does Nevada. It has a vast territory and less than one inhabitant to the square mile. It has great natural resources but they are latent and nothing but capital will lead to their development. The State is one of high general price levels, perhaps the highest in the United States. The wage scale is high by comparison with that which exists in any other state. It is not to be supposed that a condition can exist in Nevada whereby business men can be held down to the 5, 6 and even 7 per cent of profit which are the prevailing rates of interest east of the Rocky Mountains and at the same time pay men who work for wages double the Eastern scale. High wages and good profits of business must of necessity travel hand in hand.

Current News Notes

MR. GRAHAM AND MR. BELL.—According to a Paris letter in the New York *Sun*, Mr. Hanin, a French architect, is responsible for the statement that "the telephone was invented by two Americans, Graham and Bell, in 1876, and the phonograph by an American, Edison, in 1877." Further information about the Mr. Graham mentioned might be of considerable interest.

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ULTRA-VIOLET RAYS AS AID TO DIGESTION.—According to a cablegram to the New York *Times*, Prof. Daniel Bertholet, of Paris, claims to have reproduced artificially the processes of digestion on food substances by the action of the ultra-violet rays from a mercury-vapor lamp. The food was placed in a quartz container and the reactions proceeded without the aid of the usual ferments.

* * *

COLD SNAP PUTS LISBON IN DARKNESS.—The first days of January were extremely cold at Lisbon, Portugal, and considerable excitement was caused by the freezing of the ponds in the public gardens, a phenomenon without local precedent, although Lisbon is in the same latitude as Philadelphia. Incidentally the cold snap froze up the reservoir of the electric-power station, plunging the city in darkness after nightfall.

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CHICAGO COMMISSION ON DOWNTOWN IMPROVEMENTS.—Mr. Louis R. Dumond has been appointed secretary and engineer of the Chicago Commission on Downtown Improvements. Mr. Dumond has been secretary of a similar committee of the Chicago Association of Commerce. He has been instructed to gather data in relation to underground pipes and sewers and the feasibility of utility galleries in connection with subways.

* * *

YOUNG MEN AS TELEPHONE OPERATORS.—A Pittsburgh dispatch says that seventy-five young men have entered the operators' school of the Pittsburgh & Allegheny Telephone Company, and that in due time most of them will receive work as telephone operators, manning the switchboards after 9 p. m. They will displace girls, who are prohibited under a new law from working as telephone operators after the hour named.

* * *

FREE ELECTRICITY FOR MANUFACTURERS WHO LOCATE AT LOMAX, ILL.—The founders of the pre-planned manufacturing city of Lomax, Henderson County, Ill., have adopted unique plans for factory encouragement, inasmuch as they are offering to furnish power upon the following basis: To each manufacturing plant they will give free power for at least ninety years on the basis of 1 hp for each male employee, charging for additional power at the rate of $20 per hp-year.

* * *

"TESTED FIRST."—In a recent paper Mr. Edward W. Jones, of the testing department of the Commonwealth Edison Company, said that fifty-two men are necessary to conduct the work of the department. It might be added that the company has adopted as a slogan the words "Tested first." Mr. Otto A. Witte, of the same department, said that since the Fisk Street turbo-generators have been equipped with protective reactances burn-outs have become simply a tradition.

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COLLUSION OF WIRE MANUFACTURERS IN BIDDING CHARGED.—The local Hydro-Electric Commission of Hamilton, Ont., at a meeting on Jan. 31 charged that a combine exists among Canadian manufacturers of copper wire and asked for an immediate investigation. Inviting tenders from every wire manufacturing concern, the board discovered that all the bids received were exactly alike. This it took as evidence that an agreement exists between the various companies to maintain a fixed price.

* * *

FIFTIETH ANNIVERSARY, COLUMBIA SCHOOL OF MINES.—One of the greatest gatherings of engineers in the history of New York City is promised for May 28, 29 and 30, when the Columbia University School of Mines will celebrate its fiftieth anniversary on Morningside Heights. The general program provides for a reception in the gymnasium on the first day and meetings at the university on the second day, when eminent scientists will speak, followed by a banquet at the Waldorf-Astoria in the evening at which Prof. James Furman Kemp will preside.

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THE ALL-SUFFICIENT ALARM CLOCK.—Manager Cox, of the Riverside (Cal.) electric department, is reported to have constructed an ingenious device which apparently solves the servant problem by elimination. Mr. Cox is wakened each morning by a Big Ben alarm clock, which at the same time throws a switch at the back of the cabinet on which it is mounted, connecting in a circuit of four flush sockets. In one socket is a small lamp furnishing light to dress by, while the other three are connected to a toaster, percolator and grill. By the time Mr. Cox is dressed breakfast is ready.

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ELECTRIC, STEAM AND OIL DRAINAGE PUMPING.—At the annual meeting of the Illinois Society of Engineers and Surveyors in Peoria on Jan. 30 Mr. Jacob A. Harman, consulting drainage engineer of Peoria, said that at the prevailing prices for electrical energy in the valley of the Illinois River and on the Mississippi River near Rock Island it is economically impracticable to use electricity to operate drainage pumps. Mr. Harman mentioned the case of the drainage district at Keithsburg, Ill., where electric motors used for drainage pumping are being supplanted by oil engines. He said that steam-driven drainage-pumping engines are not economical in the smaller installations, under 500 hp.

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SMOKED GLASSES AND THE EARLY ARC LAMPS.—A recent historical exhibit of arc lamps and electrodes at Cleveland, Ohio, has brought out a bit of interesting history in connection with the pioneer arc-lamp system built by Mr. Charles F. Brush. The first demonstration of these lamps was made in the public square at Cleveland during the summer of 1876, and afterward in the fall of the same year the apparatus was set up at the Centennial Exposition at Philadelphia. The exhibit at Cleveland was extensively advertised in the newspapers, and on the evening it took place thousands of people assembled, most of whom carried pieces of smoked or colored glass to protect the eyes from the arc lamp's rays, which were expected to rival those of the sun.

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PROPOSED RADIO STATION AT GREAT LAKES, ILL.—Preliminary plans and estimates are being prepared for a radio station at the Naval Training Station, Great Lakes, Ill. The erection of this station has not been definitely approved, however. If it is built, it will be used for instructional purposes at the training station and to afford means of communication between the Great Lakes Training Station and the naval radio station at Arlington, Va., near Washington, and possibly with some of the naval radio stations on the Pacific Coast. The plans under consideration provide for a "wireless" plant of sufficient size to operate with the Arlington station. Two steel towers, each probably 300 ft. or more in height, will be required, together with the necessary operating buildings and equipment.

Subway Proposals in Chicago.—The project of building passenger subways continues to be an active topic of discussion in Chicago. It is probable that the voters at the election of April 7 will have an opportunity to express themselves for or against an "initial subway," to cost perhaps $30,000,000 and to be constructed principally in Clark Street and Madison Street underneath the central business district, or what is termed the "comprehensive subway," to be built beneath 70 miles or 80 miles of city streets and to cost from $130,000,000 to $150,000,000. The Board of Supervising Engineers, Chicago Traction, of which Mr. B. J. Arnold is chairman, favors the initial subway as practicable. The Mayor is believed to favor the larger plan, although no one appears to have any definite idea as to how it may be financed.

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Organization of Electrical Engineering Department of Chicago Surface Lines.—Mr. J. Z. Murphy, electrical engineer of the newly organized Chicago Surface Lines, has announced bureau heads and assistants as follows: Electrolysis and electrical distribution, Mr. H. M. Wheeler, engineer in charge; testing, Mr. V. E. Thelin, engineer in charge, and Mr. L. O. Mellor, assistant engineer in charge; substations and power houses, Mr. William Jones, superintendent, and Mr. M. Callahan, assistant superintendent; electrical installation of equipment of substations, Mr. H. Richter, superintendent, and Mr. William Wurth, engineer; lines and transmission, Mr. A. A. Thurlby, superintendent, and Mr. R. M. Patterson, assistant superintendent; tunnels, Mr. J. W. Harris, engineer. Electrical energy is purchased from the Commonwealth Edison Company.

* * *

Electrification Proposal Postponed in Chicago.—By a vote of six to four, on Jan. 29, consideration of the proposed smoke-abatement ordinance introduced in the City Council of Chicago by Alderman Long, and commonly known as the electrification ordinance, was postponed for several months. The ordinance would provide that the railroads within the limits of Chicago should operate their locomotives by some means other than steam so as not to produce smoke, cinders and noxious gases. On motion of Alderman Utpatel further consideration of the ordinance was postponed until after the Chicago Association of Commerce committee has made its report on railroad electrification. This report is not expected until midsummer. Representatives of switchmen and other steam-railroad employees have been very active in opposing the ordinance, alleging that the electrification of railroad terminals would mean death or injury to the yardmen and trainmen, and it is possible that the majority of the committee realized that it would be a good political move to postpone consideration of the pending ordinance until after the spring election.

* * *

Electrification Investigation in Chicago.—On behalf of the Chicago Association of Commerce it is announced that the concluding stages of the work of the committee on smoke abatement and electrification of railway terminals are in sight. The work was begun in the summer of 1911 and the investigation made has been most elaborate. Within the zone of investigation there are 4500 miles of railroad track, 100 railroad yards and the industries of a great manufacturing city. Exhaustive researches have been made into the questions of feasibility and practicability of electrification, as well as the problem of smoke production and suppression. A large staff of engineers, inspectors, accountants and clerks has been employed on the work, which was for a considerable period under the direction of the late Horace G. Burt as chief engineer. Mr. Burt was succeeded by Dr. W. F. M. Goss, dean of the College of Engineering of the University of Illinois, who obtained leave of absence for the purpose of acting as chief engineer of the committee, of which he is also a member. The exact time for the appearance of the report has not been fixed, but it is hoped that it will be early in the present year.

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"Safety First" at St. Louis.—The Union Electric Light & Power Company, St. Louis, Mo., has recently organized a central safety committee composed of the various department heads of the company. The work of the committee, as outlined at its first meeting, has been divided into four sections, namely, analysis and discussion of accidents that have happened with the object of preventing their repetition; analysis and discussion of circumstances and conditions under which accidents might happen in order to keep down the number of preventable accidents; recommending installation of safety devices with a view to preventing accidents; passing upon features of standard practice with safety objects in mind. The central committee will appoint other committees in their various departments and, co-operating with these sub-committees, will receive suggestions from the men actually engaged in the operating and plant departments of the company. Printed suggestion cards will be distributed among the men as a means of gathering their ideas. The personnel of the central committee is as follows: Messrs. John Hunter, H. Spoehrer, J. L. Fay, F. C. Brooks, J. E. Hillemeyer, C. S. Ruffner, H. W. Eales, E. S. Wills and G. S. Hessenbruch.

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SOCIETY MEETINGS

Jovian Activities in Chicago.—At the meeting of the Chicago Jovian League on Feb. 9 Mr. A. N. Fox, advertising manager of the Benjamin Electric Manufacturing Company, gave an interesting talk on "Advertising." The next rejuvenation in Chicago will be held at the Hotel Sherman on March 5.

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Institute of Radio Engineers.—At the meeting of the Institute of Radio Engineers, New York, Feb. 4, Vice-president John Stone Stone read a paper contributed by Mr. C. Tissot on "The Influence of Alternating Currents on Certain Melted Metallic Salts." These salts when subjected to a direct potential became materially better conductors and maintained their conductivity after a removal of the potential, but the application of radio or audio-frequency alternating potential materially decreased their conductivity. At the Washington Section of the Radio Institute on Feb. 5, Mr. Frederick Kolster contributed a paper on "The Measurement of Logarithmic Decrements," including a description of his latest decremeter.

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St. Louis Company Section of N. E. L. A.—The monthly meeting of the Union Electric Light & Power Company Section of the National Electric Light Association in St. Louis was held on Jan. 30. There was a general discussion of the best methods to be adopted in increasing the membership of the association. Messrs. Hunter, Wills, Hutch, Haddaway, Spoehrer, Scullin, Drabelle and Clarkson participated, Mr. Hunter's contribution being written. Mr. Spoehrer called attention to the fact that one-half of the dues are paid by the company. Mr. C. E. Brenton, auditor of the company, read a paper on "Maintenance and Investment of Public Utilities," which was discussed by Messrs. Einstein, Fay, Clarkson, Gamp and Worthington. The Union Electric orchestra made music and a motion-picture show was given by Mr. D. Scullin.

Recent Developments in Constant-Current Transmission

Operating practices of the series, high-tension direct-current system developed by M. Thury in Europe, with notes on efficiency. By Dr. Louis Bell

ANYONE who examines with an open mind one of the big constant-current direct-current series transmission systems such as have been installed by M. Thury in various parts of Europe inevitably comes away with a realization that, whether he thoroughly approves of the system or not, it works remarkably well. Most American engineers have an ingrained opinion that whenever long-distance work is to be done three-phase transmission is the only thing to be seriously considered. The writer may fairly claim to be the original three-phase "rooter" on the western side of the Atlantic, but he must honestly admit that after having gone over some of the recent work abroad in constant-current transmission and having examined some of the beautiful machinery developed for the purpose he has acquired a disposition to take the system seriously and to admit that it has some exceedingly strong points when working under favorable conditions.

An examination of the workshops of M. Thury and records of the machines made there is absolutely convincing as to the operative character of the Thury system. Perhaps the hardest thing for the average engineer to realize, if he has not investigated the system, is the fact that the Thury method is not in the least intended for miscellaneous distribution of transmitted energy, but as now worked out is fundamentally for long-distance and high-voltage transmission, leaving to the more familiar methods the work of distribution.

Specifically, the strongest point of series transmission is its ability to deal with enormously long lines—underground if need be—with a maximum factor of safety and a minimum likelihood of interruption. Whatever may be the effective maximum of working pressure necessary, it can always be reached by direct current within about 70 per cent of the maximum voltage stress necessary with alternating current, which means, in principle at least, materially easier insulation whether the lines are overhead or underground, besides in the latter case avoiding the dielectric hysteresis which is liable to become serious in cables at high pressure. The average insulation stress, instead of always being equal to the maximum as in the three-phase system, is merely the maximum working pressure multiplied by the load-factor. On the other hand, the line loss on the series system is constant so that the high load-factor is particularly desirable.

Construction of the High-Tension Machines

One of the points of greatest interest to the investigating engineer lies in the construction of the high-tension generators and motors. The writer examined with much interest the large machines such as are used in the Moutiers-Lyons transmission and studied their construction in the shops. They are 1500-kw units generating approximately 150 amp at 10,000 volts, and, as shown in Fig. 2, have twin armatures with three bearings. This construction immediately suggests the

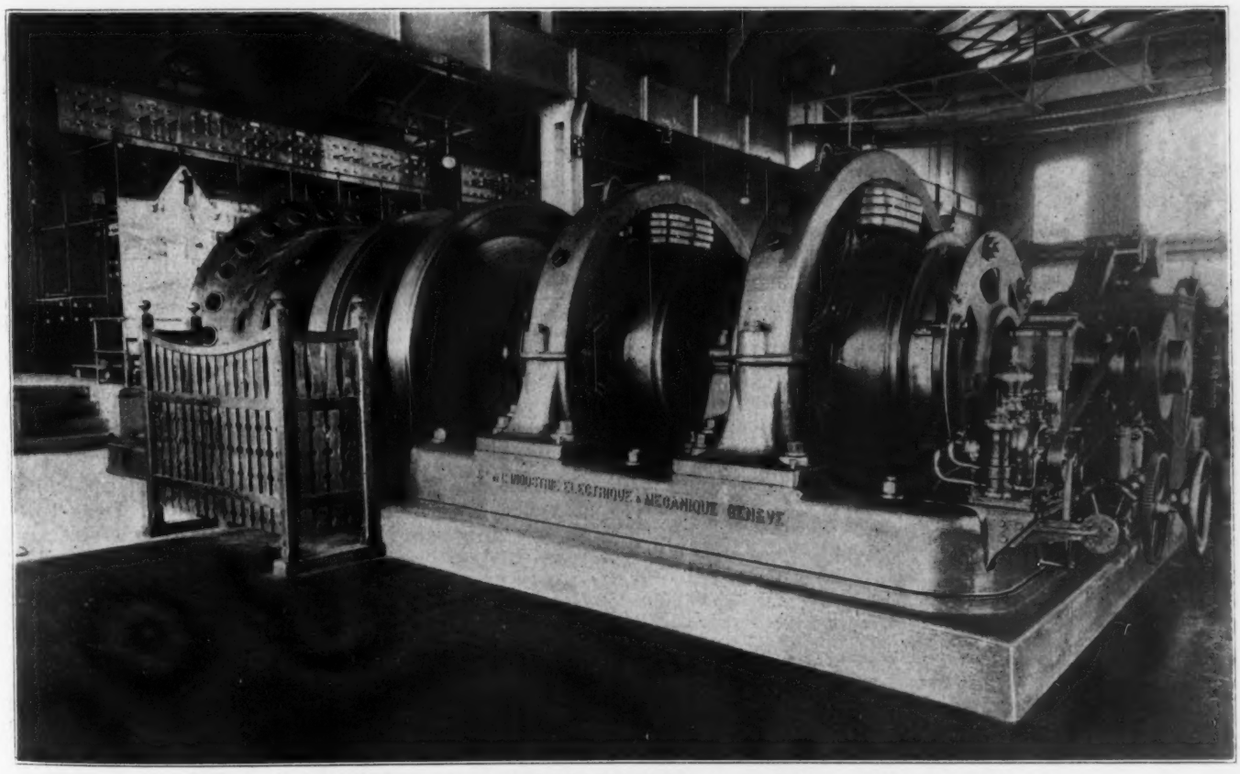


FIG. 1—HIGH-TENSION MOTOR-GENERATOR SETS IN VAULX-EN-VELIN SUBSTATION

limited output of a high-voltage direct-current machine, and it may be pertinent here to investigate the real facts in the case. The fundamental point is, however, the fact that the limitation to the voltage which can be derived from a single armature turns out to be the peripheral speed of the commutator. These big machines of whatever amperage carry about 25 volts per bar with one armature turn per bar. The winding used, as may be judged from the illustration, is a series drum with straight overhanging ends, the diameter being 1.5 m (59.1 in.). The commutator diameter measures 1.2 m (47.3 in.). The collecting surface of each bar is about 3 mm (0.118 in.) wide, and it may be said that up to these dimensions, at all events, the commutation is beautiful. The mica used as insulation has been selected with a view of giving uniform wear, which it certainly does. Bearing in mind that the winding is limited to one turn per bar, it is clear that the chief constructional question is how fast the commutator surface can be run since the bars cannot with advantage be narrowed and the voltage on them cannot be much increased. The machine shown has a commutator speed at its surface of about 27 m (88.8 ft.) per second. This could be raised by 10 per cent or 15 per cent easily, but perhaps not very much more,

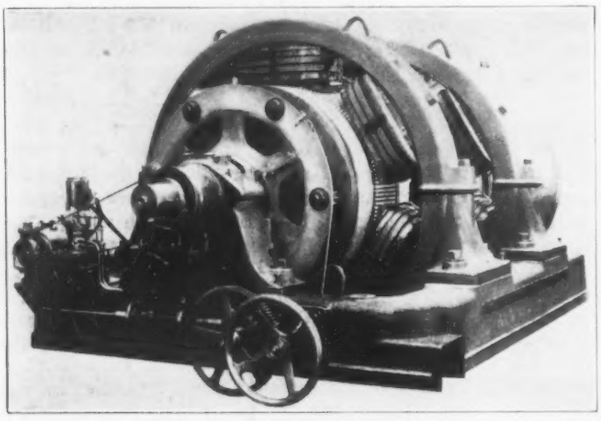


FIG. 2—A 2000-HP, 2 × 4565-VOLT CONSTANT-CURRENT GENERATOR, 428 R.P.M.

although exactly how much remains to be seen. The present limit of pressure, then, is about 5000 volts per commutator.

As to the output per armature available, that is quite another matter. Fig. 1, which shows one of the motor-generators in the substation of Vaulx-en-Velin, displays to advantage the commutator of one of these big machines. The brush surface is scarcely 100 mm (3.9 in.) wide and it takes care of 150 amp. While, therefore, one cannot much raise the voltage, it is superlatively easy, in case a large amount of energy is to be transmitted, to increase the amperage, so that while the machines in the Moutiers-Lyons plant take only 150 amp no difficulty is to be apprehended in building machines of similar voltage for 400 amp or 500 amp. Indeed, the great transmission scheme from the upper Rhone to Paris was actually laid out for 400-amp machines. One may, therefore, say roughly that the single armature can be pushed to nearly or quite 2500 kw—that is, 10,000 kw for a duplex machine of the type here considered.

Regulation by Servo-Motor Governors

A word next as to regulation. All machines, both generators and motors, of the Thury system are now controlled by a beautifully sensitive type of governor operated by a servo-motor worked by air or oil pressure. The mechanism is quite similar in construction regardless of whether it operates for constant speed, constant current or constant voltage, and whether it controls a waterwheel or shifts the brushes. The general appearance of the governor is shown at the left in Fig. 1. The detail of the governor is worked out with wonderful ingenuity, particularly the provisions against hunting, and its sensitiveness can be made extraordinarily great. On these particular big motors the governing is duplex. On one side the servo-motor is controlled by a delicate centrifugal governor set for constant speed of the motor. The mechanism as actually tested is sensitive to 0.2 per cent variation in the speed. On the other side it is equipped for amperage control by means of a solenoid for use on occasions when the machine may be driven as a generator by the three-phase unit to which it is coupled, making a convenient provision for mutual service between substations. The current control is of about the same degree of sensitiveness, although in point of fact the speed regulation is usually set at about 2 per cent, as a little leeway tends to check the small hunting which might otherwise occur. All the working parts of the governor are automatically kept free and in play so that there seems to be no chance of failure to function through sticking.

The problems of insulation of these high-voltage machines are interesting ones. To begin with, the machines themselves must be thoroughly insulated from earth on account of their series connection and also from a reasonable probability of their being worked with a grounded line as an emergency measure. In earlier plants this was done by mounting the machine itself on insulating blocks on its foundation. In the later and larger plants the insulation is applied between two layers of the foundation, so to speak. Little trouble has been experienced with this insulation, which apparently is one of the things much easier in actual practice than it perhaps seems from a casual glance.

Fig. 3 shows the insulated couplings between the waterwheels and the big generators. The particular plant illustrated here is that at La Bridoire, in Savoy, a station auxiliary to the main plant at Moutiers and containing four 1500-kw generating sets as shown in the illustration. The coupling referred to lies between the generating unit and the flywheel attached to the waterwheel. It is in the neighborhood of 1.5 m (6 ft.) in diameter and consists essentially of two massive face plates each provided with a ring of heavy steel pins parallel to the shaft. One ring lies radially within the other with about 30 cm (12 in.) intervening, and a continuous leather belt is woven in and out between the two sets of pins. Thus there is formed a flexible coupling with the belt spans as insulation, making a connection both highly effective as an insulation and very flexible. These big three-bearing units are separately excited by directly connected exciters and have an efficiency of about 95 per cent at full load, which compares favorably with that of other machines of similar size.

The regulation of this particular plant at La Bridoire as well as that of a still more recent station of about half its rating operating at Bezil, Savoy, is interesting from the standpoint of being regulated for constant speed. The current control is accomplished by shifting the brushes. The main plant at Moutiers is operated at a varying speed of the generators to secure uniformity of current. The reason for the difference is very simple. At both the later plants the water supply is somewhat scant, and especially is this true at Bezil, where Pelton wheels are operated under high head. It is therefore far more desirable to conserve water by keeping the wheels always at their most efficient

speed; hence the method of governing by shifting the brushes instead of adjusting the speed.

Simplicity of Control Equipment

One notes in Fig. 3 that little in the way of a switchboard is visible. This is because of the exceedingly simple reason that there is not any, except for a few devices associated with the control of the regulators and the necessary instruments for the outgoing line. On the base of each generator, however, will be seen a square column, better shown in Fig. 4. This is the operating switch for short-circuiting or throwing into action each machine together with the voltmeter and ammeter which serve as guides, and this panel comprises all there is in the way of a working switchboard. If the reader will but stop and think of the difference between this and the fortifications of concrete which surround the multifarious switches of an ordinary three-phase plant, he will come to a sudden realization of one of the conspicuously strong points of series operation. While the generating equipment itself is obviously somewhat expensive, M. Thury holds, and has the figures to justify his belief, that compared kilowatt for kilowatt, including switchboard and buildings, the constant-current system can fully hold its own in high-tension operation.

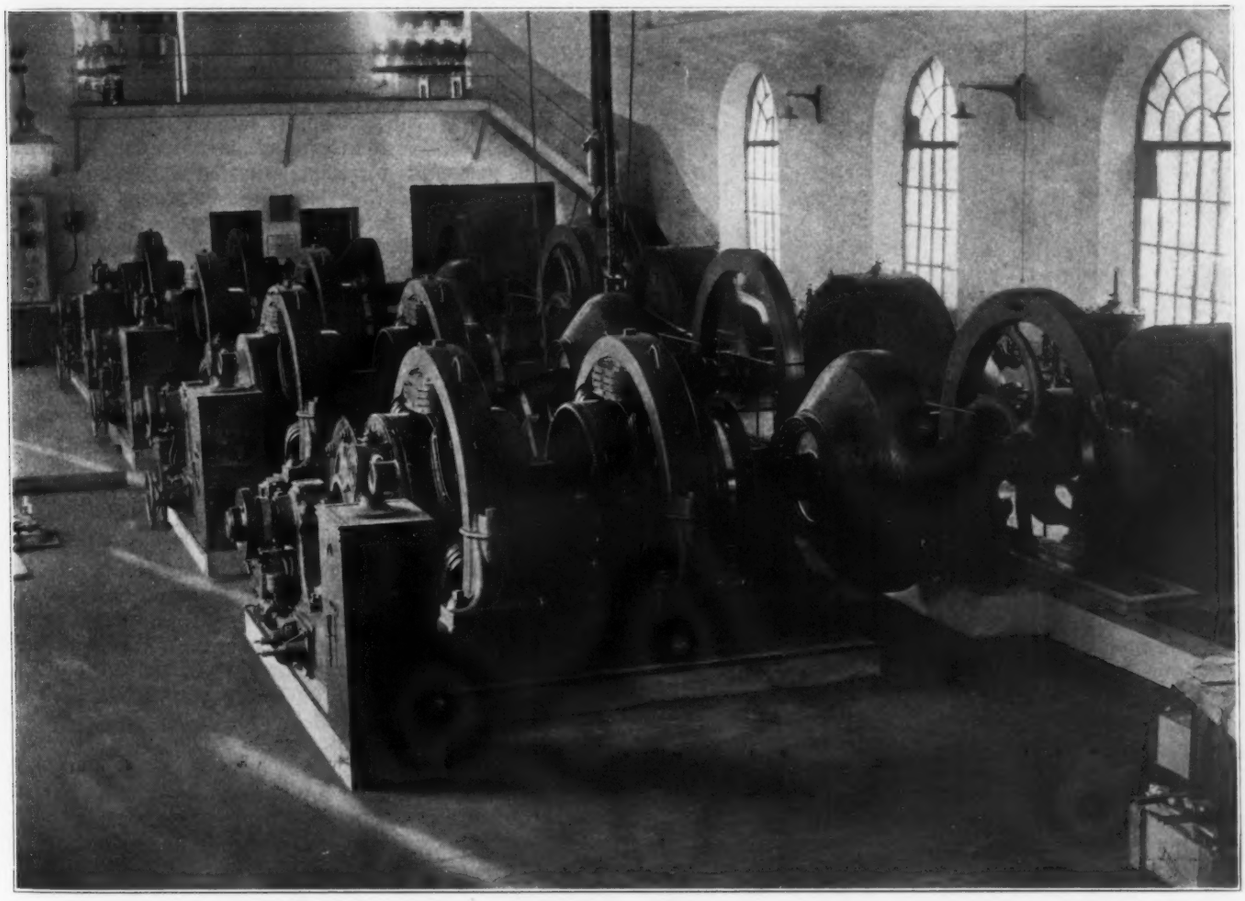


FIG. 3—2000-HP CONSTANT-CURRENT GENERATOR SETS IN THE PLANT AT LA BRIDOIRE

It may be interesting to see how a typical long-distance line would work out for a series constant-current connection. Take, for instance, the transmission of 75,000 kw over a 250-mile line at 150,000 volts working pressure. With 10 per cent loss in the line this would require cables of about 1,000,000-circ.-mil. cross-section. This copper could perhaps be divided into two circuits each of 500,000-circ. mil cable, each circuit being strung on an independent pole line. The total weight of cable would be about 4000 tons. This would mean at ordinary prices of copper an investment of less than $20 per kw for the conductor, which certainly is not excessive. A duplex line of this kind would allow working at a pinch on one circuit, or with two cables on one leg and one on the other; and, what is perhaps more important, it is as a matter of fact perfectly feasible to work these constant-current circuits grounded. The resistance of the ground return depends, as was well shown in the experiments made with reference to the proposed Paris transmission and reported in the *Electrical World* a few years ago, on the extent and proper installation of the ground plates. The ground resistance can be easily made less than the resistance of the return wire would be, thus giving very great additional security against accidents to the line. Practically all the high-tension plants on this system have actually been worked commercially with ground return for considerable periods, so that use of this method is not in the least a matter of theory but of actual experience. The maximum voltage on a 150,000-volt line using direct current is about 60,000 volts less than in the case of an alternating-current line of any kind, giving a large additional security to the insulation and this also without counting the abnormal rises in potential to which alternating-current lines are subject. The generating station of such a system would depend largely on the character of the hydraulic development, but, given favorable conditions such as exist in some alternating-current plants, the equipment need consist of only eight water-wheel units, each driving a pair of 10,000-volt three-bearing machines such as have been described, while at

the receiving end a similar group could be connected in pairs to three-phase generators for ordinary distribution. The efficiency of the substation equipment from high-tension line to three-phase distributing buses should be slightly over 90 per cent at full load. The weak point of series working lies in its lowered efficiency at part load, owing chiefly to extra line loss. But

FIG. 4—CONTROL PEDESTAL FOR A 2000-HP GROUP

the actual showing in efficiency made should be on the whole good. This outline merely indicates how the system would work out on a large scale.

Possibilities in Underground Transmission

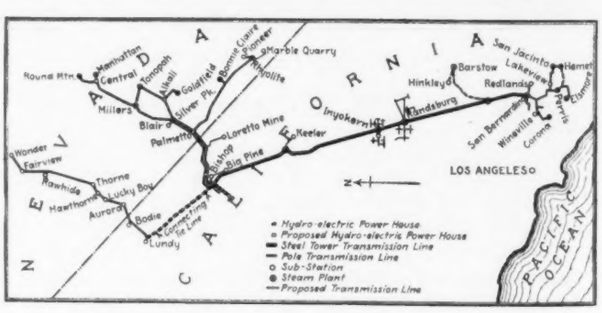
A far more favorable case for the series system is that in which the transmission lines are underground. Nobody yet knows exactly what are the relative difficulties to be met with in high-tension direct-current and alternating-current cables, but there is every indication that the direct-current cable even at moderate voltages has a great advantage in insulation strength, perhaps in the ratio of 2 to 1 or 3 to 1 at 25,000 volts or 30,000 volts, and in much greater ratio as the voltage rises. It is probably well within bounds to say that 150,000 volts direct current is as easy to put underground as 60,000 volts alternating current, which is at present about the highest figure that has been tried. It is this feature of the constant-current system that recommended it so strongly in the transmission system for the supply of London, for which it was recently adopted. Here the situation required transmission wholly underground over a large territory with here and there substations for distribution, a condition to which series operation at constant current is particularly adaptable, and showed, according to the figures of the engineers, so large an advantage as fully to justify its choice. More data on this cable problem are necessary but cannot be taken as really reliable until competitive estimates are made on the basis of tests for both alternating-current and direct-current working—tests more extensive and covering a wider range of construction than are yet available. From what has here been set forth it must not be understood that series transmission should be regarded as a general competitor of three-phase working for high-tension and long-distance work. It is rather a thing which under certain circumstances has been found to have certain conspicuous advantages and which on its record must be taken seriously as a possible recourse when conditions are favorable. The plants actually in operation are doing excellent and reliable work, and there is no reason why they should not continue to do so. Even with overhead circuits the series scheme possesses elements of security, especially with respect to lightning, which are not to be despised, as reactance coils may be used with the utmost freedom. At all events, the constant-current system of series transmission is one of extreme interest to the engineer, and even if it should not be advisable to undertake such work in this country under present conditions its features of simplicity in operation are such as should stimulate the improvement of three-phase transmission in the direction of simplicity of switch gear and adaptability to underground working.

Providing for Exchange of Surplus Energy

To provide for the exchange of surplus energy generated by the Pacific Power Company, the Nevada-California Power Company and the Southern Sierras Power Company, a tie line is being erected between Bishop and Lundy, Cal., to connect the three systems. Normally it is not proposed to operate the Pacific system in synchronism with the other pair, the two groups of circuits being segregated except when energy is being transferred. The tie line, a single circuit, is about 65 miles long and is now strung on wooden poles which will eventually be replaced by steel towers. When completed the line will connect six hydroelectric plants and two steam plants having a total rating of over 46,000 hp.

At present the Pacific company generates its energy by steam power at Bodie, Cal., and has a transmission system about 125 miles long. The Nevada-California company operates five hydroelectric plants near Bishop, Cal., and transmits over duplicate lines the energy thus generated to seven transformer substations in Nevada. Two more hydroelectric plants are in preparation at Bishop which will supply energy to new territory remaining undeveloped at present. In the vicinity of the new tie line on the Owens River and on Silver Lake there is considerable unexploited mining country.

A double-circuit steel-tower transmission line already connects Bishop with San Bernardino, where the steam generating station of the Southern Sierras company is located. This line is about 236 miles long and, while it is now being used for sixty-cycle, 55,000-volt transmission, it was designed for pressures up to 143,000 volts. The Bishop-San Bernardino line is installed to allow synchronous operation of the two systems, but the steam station at its southern end is normally held in



TRANSMISSION LINES IN VICINITY OF LOS ANGELES, CAL.

reserve and used only when the water supply at Bishop is insufficient for generating all of the energy required.

As the Southern Sierras company now has a distributing system about 225 miles long, further extensions or large increases in load will warrant a higher transmission voltage than is now used. The first increase contemplated will be from 55,000 volts to 90,000 volts.

Alternating-Current Supply in New York City—II

New station of the United Electric Light & Power Company at 201st Street and Harlem River—Generation and control of the electrical energy

IN the *Electrical World* of Feb. 7 was published a history of the growth of the alternating-current system in New York City with a brief mention of the features of the United Electric Light & Power Company's new 201st Street generating station, which will carry the entire sixty-cycle load in that city for some time to come. In the same article were also described the coal-handling and boiler-room equipment. The present article contains a description of the remaining mechanical equipment and goes into detail concerning the electrical installation.

Cinder Catchers

Besides setting the boilers extra high above the grates to prevent smoke when the boilers are forced, additional preventive measures have been taken by employing cinder catchers and gas cleaners. As the boilers are set back to back with three firing aisles, one cinder catcher suffices for two boilers. The cinder catcher consists of a rectangular steel tank connected with the boilers adjoining it by two horizontal flues and with the smokestacks by a vertical pipe. The bottom of the tank is kept covered with water about 2 ft. deep, and adjustable baffles deflect the gases from the boiler against the water, at the same time causing them suddenly to change their direction and pass out the vertical pipe. The centrifugal force of the moving cinders causes them to be thrown into the water, from which they are drained periodically through a pipe at the bottom. The speed of the gases as they strike the

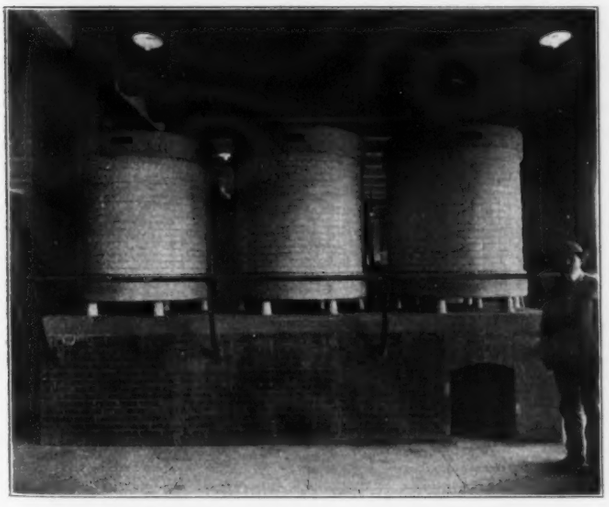


FIG. 10—PORCELAIN-CLAD BUS-TIE REACTORS

water can be regulated by adjusting the baffle plate. If the gases from the boilers are filled with finely divided solid material which will not be entrapped in the pool of water, a curtain of finely divided water can be run over the baffles to clean the gas. This apparatus was installed by the Metropolitan Engineering Company of Brooklyn.

Ash-Handling and Electric Locomotives

Ashes and cinders can be dumped from the separate downtakes directly into cars in the basement. Two trolley-type 220-volt, 10-hp General Electric locomotives are provided to haul the loaded ash cars to a hopper, from which the ashes are conveyed in motor-

FIG. 11—REACTORS IN 7500-VOLT EXCITER-MOTOR LEADS

operated skip-hoists upon an inclined track to a large concrete ash bunker supported between the coal towers. The skip-hoist will dispose of 40 tons of ashes per hour. From the concrete bunker the ashes can be discharged by gravity through chutes into ash scows or freight cars. The electric ash locomotives are operated by two 5-hp direct-current motors, energy being supplied through sliding-contact shoes from an overhead conductor.

Piping

Four parallel boiler headers connect the boilers in each row with the main steam headers stretching across the east and west ends of the boiler room, as was shown in the isometric drawing published last week. U-bend cross-overs connect the boiler-superheater outlets with the boiler headers. A gate valve operated from the floor is connected in each boiler lead. Expansion of the headers is provided for by supporting the pipes on rollers and dividing the headers into sections joined by U-bends. Steam leads are run from the main header down below the engine-room floor level and thence to the turbines, first passing through 14-in. steam separators capable of passing 240,000 lb. per hour.

Below the main header and connected to it is an auxiliary header feeding circulating, hot-well and air pumps. Two atmospheric exhaust stacks connecting with a 25-sq. ft. longitudinal tunnel in the engine-room floor are at opposite sides of the building. All condensers are connected with the exhaust tunnel through automatic relief valves.

Feed-Water Heaters

The boiler-feed water consists of condensate and about 10 per cent make-up from the Croton Aqueduct. Two Cochran feed-water heaters and a dividing box are installed to care for the present installation. The make-up water and condensate from the main turbines and auxiliaries is measured separately before going to the condensers by Lea V-notch recording meters. The dividing box used with the condensers equalizes the water delivered to each heater so that neither is overworked. Three centrifugal turbine-driven pumps receiving water from the heaters by gravity deliver water to the boilers.

FIG. 12—MOTOR-DRIVEN BLOWERS FOR TURBO-GENERATORS

Test Room

A test room containing condensers, weighing tanks, Venturi meters, etc., is located in the ash basement and can be connected with all turbines, auxiliaries and condensers by auxiliary headers to measure the steam consumption, economy, etc. In addition, a reciprocating air pump is installed for testing the air leakage of any condenser.

Turbo-Generator Equipment

While designed to accommodate eight 19,000-kva horizontal turbo-generators, the turbine room now contains only three three-phase, sixty-cycle units. These are Westinghouse horizontal double-flow machines and will develop 7500 volts when operated at 1875 r.p.m. With a steam pressure of 185 lb., a superheat of 125 deg. Fahr. and a 28.5-in. vacuum, the turbines will develop a maximum of 22,500 brake hp. The turbines are arranged in a single row with their longitudinal axes parallel and are supported on plate girders resting on steel columns. Each turbo-unit has an over-all measurement of 41 ft. by 14 ft. by 9.5 ft. Below them in the basement are arranged in units the condensers, auxiliary pumps and motor-driven blowers. Westinghouse two-pass surface condensers are employed having 20,000 sq. ft. of cooling surface. They are supported on steel-girder platforms directly below the turbines so there is no friction loss in exhaust piping.

Condensing water is conveyed to the building from the Harlem River through a 83-sq. ft. suction tunnel which connects with a cross-tunnel extending the length of the auxiliary-room floor. An 89-sq. ft. discharge tunnel superposed upon the latter empties into Sherman Creek.

Water from the suction tunnel is forced through each condenser by a turbine-driven Westinghouse Leblanc centrifugal pump. The pump operates at a maximum speed of 1000 r.p.m. and is connected to a variable speed turbine through a 3-to-1 double helical floating frame gear. Gear reduction is employed so that the pumps and turbines will operate at their highest efficiency, and the economy afforded by its use has warranted its installation. The turbo-gear drive is a feature throughout the station, there being fifteen such outfits. Each circulating pump is capable of delivering 24,000 gal. per minute, so that when the ultimate equipment of eight turbines and auxiliaries is installed the pumps will be able to deliver over 103,000,000 gal. per day. The air pumps are of the rotary-turbine type directly connected to 75-hp turbines running at 3500 r.p.m. Horizontal single-stage, double-suction centrifugal pumps directly connected to 15-hp turbines are used to deliver water from the hot-wells to the feed-water heaters.

Each turbine has its individual oil-circulating system. When starting up a turbine a small reciprocating engine starts the oil circulation, which is normally maintained by a centrifugal pump geared to the turbine shaft when the latter is running at full speed.

Generator Ventilation

Sufficient space is not available for ventilating blades on the rotors of the main generators as they are designed for a relatively high speed. Consequently individual motor-driven double-width blower units are provided to cool the generator windings. A 110-hp motor is directly connected to each end of the individual blower shafts, one motor serving as an emergency reserve. Separate circuits are run from the power board to each motor, thus insuring independent operation.

Electrical Equipment

All control and switching apparatus is installed in the west section of the station. The high-tension remote-control and main-generator-control boards are placed on the third gallery in a room overlooking the engine room. Both switchboards are semi-circular in plan, the high-tension board consisting of two concentric semi-circular sets of boards with conduit

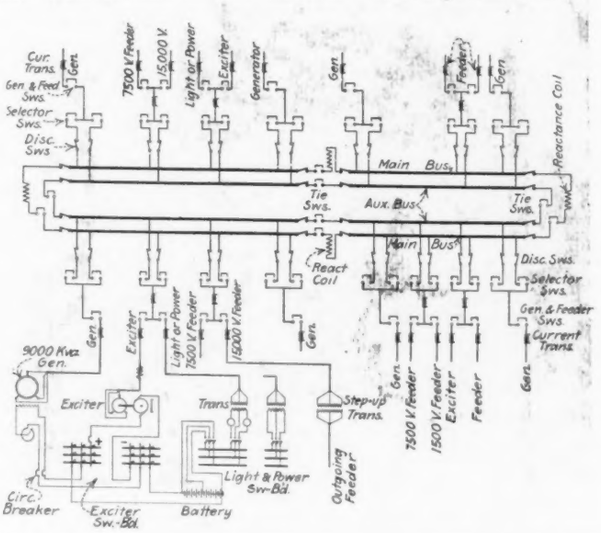


FIG. 13—FOUR-SECTION BUS WITH REACTORS AND TIE SWITCHES

space in between. On the larger-radius board are mounted watt-hour meters connected to all generator and feeder circuits. Switches are also located on these boards which permit of testing any meter, series or shunt transformer without erecting special apparatus. Installed in this room are also static detectors employed to indicate grounds on any one of the four high-tension bus sections, and indicators to show the particular feeder circuit grounded. An elaborate signaling device is installed for transmitting orders to the boiler room and for governing the movements of turbine operators. The signal installed in the boiler room is of the carriage-call type and indicates the number of boilers which will be required to carry the load. The indicator control device automatically records on a tape the signal transmitted, the time it is sent, and the time it is acknowledged. Another board containing pilot lamps also shows the position of all oil switches (open or closed) in the station. A similar board connected with it gives the same information to the load dispatcher at Waterside station.

Electric Galleries

The high-tension bus and switch compartments are distributed over the floors of the electrical galleries, of which there are seven. The arrangement of the switching apparatus and the connection of the generators and feeders to the buses is shown in the accompanying diagram.

On the sixth gallery are located the bus-tie switches and air-cooled, porcelain-clad, pancake-type reactors connected in series with them. These reactors are designed to carry 2000 amp and have a reactance of 18 per cent. The coils are supported on porcelain insulators resting on concrete bases, and all metal bracing of bus compartments used in conjunction with the coils is made of brass to prevent magnetic leakage. Short-circuiting switches are installed in compartments near each reactor to shunt the coils in case they are out of order.

Main and auxiliary high-tension buses, each of which consists of four copper strips in parallel, are supported in compartments on the fifth floor. These buses are divided into four sections as indicated in the bus diagram and can be connected in two loops through the bus-tie switches and reactors on the floor above.

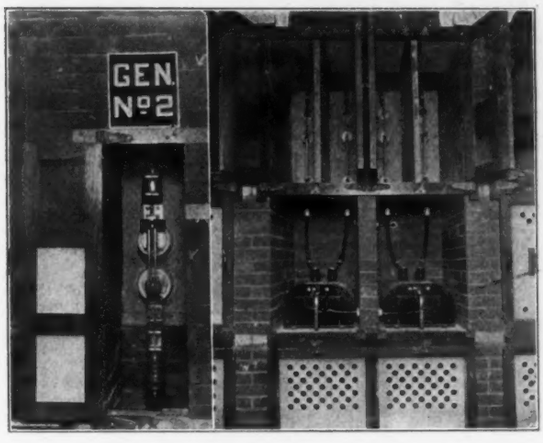


FIG. 14—DISCONNECT-SWITCH COMPARTMENT AND AIR-COOLED SHUNT-TRANSFORMER COMPARTMENTS

Only two sections are completely installed now, the others not being required until more turbo-generators are put in. Each bus section is fed by two generators through oil disconnecting switches installed on the third gallery with the feeder switches.

The bus and oil-switch compartments are built of red brick, each phase of a circuit being separated by alberene barriers. Removable alberene floor panels are installed in front of each high-tension compartment to facilitate pulling of cables.

In the second gallery are located the shunt and series instrument transformers connected to each feeder and

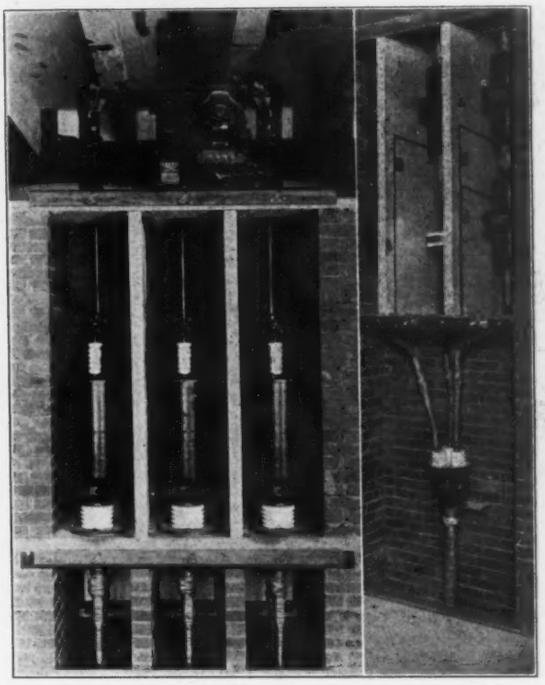


FIG. 15—BUS-TIE OIL SWITCH AND COMPARTMENTS CONTAINING INSTRUMENT AND RELAY SERIES TRANSFORMERS

generator circuit. Separated transformers are used to operate instruments and relays, the series transformers being arranged in one row of compartments and the shunt transformer in an adjoining row separated only by a brick partition. Space has been provided below the shunt transformers for a future installation of feeder reactors. Only two will be installed in each circuit and these will be designed to carry 300 amp and have 4 per cent reactance. In the compartments on this floor there are also special series transformers which are clamped around the three-phase, three-conductor feeder cables. When a feeder circuit is unbalanced the vector sum of the currents is no longer zero and the transformer will operate a relay in the high-tension switching room indicating the unbalanced condition.

Selector switches are installed on the fourth floor to connect the feeder and generator switches to either the main or auxiliary bus.

The feeder-switch relays are designed to open when 800 amp flows after an interval of two seconds, and in case the overload exceeds 2000 amp the selector switch will open in the same length of time. Instead of the generator switches being tripped on overloads, however, a signal lamp is lighted on the machine-control board. To safeguard men working on oil switches special grounding devices are placed at several points in each high-tension gallery. This apparatus consists of an insulated rod with a metal tip connected to a flexible cable, one end of which is grounded through an expulsion fuse. Before discharging the static from a switch the continuity of the testing circuit is tested by touching the tip of the rod on a metal plate which is

connected to the ungrounded conductor of a grounded lighting circuit through an incandescent lamp. The lamp will light if the cable is grounded, and the high-tension switch to be worked upon may then be discharged. After discharging the static separate flexible cables may be fastened to the switch and the other ends connected to a grounded copper strip extending along the base of the switch compartment. All oil

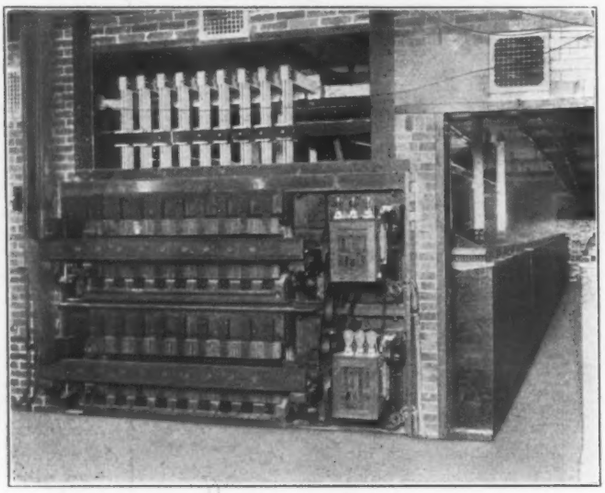


FIG. 16—AUTOMATIC END-CELL-SWITCH AND BATTERY ROOM

switches in the electrical galleries are motor-operated and were made by the General Electric Company.

Exciters and Control

Field exciting current for the 19,000-kva generators and energy to charge a 142-cell storage battery on the first gallery is furnished by three 200-kw, 250-350-volt exciters located in the first basement. These exciters are driven by 7500-volt, sixty-cycle induction motors having 15-amp, 3.33 per cent reactances in series with their leads. The motor-starting controllers are installed near them and are operated by the low-tension switchboard operator. The exciters deliver energy to the low-tension switchboard and can be connected to any one of three buses. Different bus voltages can thus be maintained by segregating the exciters, and the entire 142 cells of the storage battery may be charged from one exciter while the others deliver exciting current to the generators. Normally, however, the storage battery is floated on the exciting bus.

The exciter control board consists of three separate sections, the positive and negative panels at opposite ends, with a control board in the center. The switch contacts are on the front of the positive and negative panels while the buses on the rear are protected by alberene barriers and asbestos-wood doors. The wiring in back of the boards is run in iron conduit, making a construction that is completely fireproof. The exciter and generator field switches, which are of the Van Vleck knife type, are spaced so as to prevent any accident which might result from arcing at the switch contacts. At the top of the exciter panels are mounted circuit-breakers equipped with reverse-current relays. The field current of the 19,000-kva generators is controlled entirely from the high-tension switchboard room; the remote-control switches located there operate field circuit-breakers and rheostats on the first gallery.

Storage Battery

The storage battery, consisting of 142 thin-plate Exide cells (3500-amp-hr. at one-hour discharge rate), is at the south end of the first gallery. The cells are arranged in three rows and each one is supported on six glass oil-ring insulators which in turn rest on a plate supported by four porcelain insulators. The end-cell connections which are coated with acid-proof paint are supported from the ceiling by porcelain insulators. An auxiliary bus extends over each row of cells and is connected to a 5-volt, 1000-amp motor-driven direct-current generator so that any cell can be charged individually. This generator is designed to operate as a booster, should it be required to do so. The battery room is ventilated by exhaust fans, and the air is washed to remove the acid before discharging it through the ventilating ducts.

The number of cells connected in series across the exciter bus is regulated by an automatic remote-control end-cell switch placed on the exciter control board. An illuminated shutter on the remote-control switch indicates the number of the cells in series, as well as the direction in which the end-cell switch is operating. A red light means that the number of cells is being increased, a green light indicates a decrease, and a white light shows that the switch has connected the number of cells indicated on the shutter. It is only necessary to turn the switch handle until the number of cells desired is indicated on the shutter and the end-cell switch performs the operation automatically.

30,000-Volt Testing Set

Installed in the room with the exciters is an induction-motor-driven testing generator which supplies energy to a 30,000-volt testing transformer. The testing generator is controlled from a switchboard in the third gallery and 30,000-volt cables connect the transformer with testing stations on the different galleries, there being from two to four stations on each floor.

Power and Lighting Distribution Room

The station lighting system and motor equipment is supplied with energy from transformers in the sub-basement. Two banks of 7500/440-volt transformers deliver energy to the motor feeder board in the exciter room and two other banks of T-connected trans-

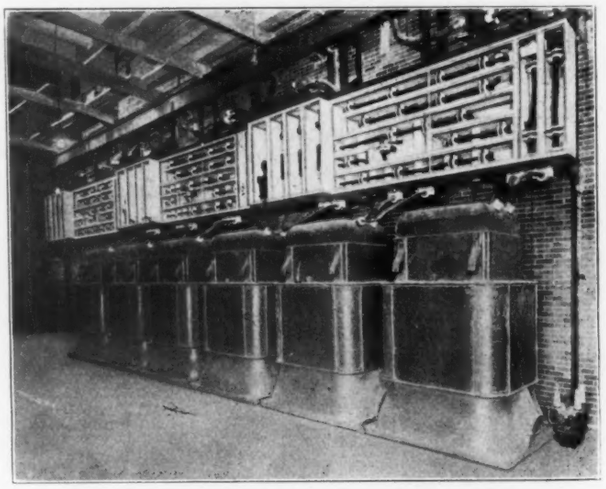


FIG. 17—WALL COMPARTMENTS CONTAINING 15,000-VOLT TRANSFORMER CONNECTIONS

formers deliver two-phase energy to the lighting board, also in the exciter room. Expulsion-type switches made by the Metropolitan Engineering Company, Brooklyn, are used on all of the feeder and distributing switches of both motor and lamp circuits. Two single-phase 7500/220-110-volt lighting transformers are employed with their primary windings T-con-

nected, and 220-110-volt taps are led from their secondaries to the lamp feeder board. Both secondary circuits from the lighting transformers are run to each distributing box in the station so that in an emergency a polyphase motor may be operated temporarily on the two-phase energy. Voltage regulators are in series with all of the lamp circuits in the station. Emergency lamps connected directly to the exciter bus are also distributed throughout the station. Later a system will be installed whereby the lamps can be connected to the storage battery should the alternating-current buses become de-energized.

Transformers Feeding Substations and Tie Lines

As the feeders to the outlying substations and the tie lines to the Waterside station operate at 15,000 volts, six banks of 2000-kw, 7500-15,000-volt transformers have been installed to step-up the generated voltage. Three of these deliver energy to the Waterside station and the remainder to substations. Each bank of transformers is air-cooled by an individual motor-driven blower which starts to operate as soon as the transformer bank is energized. The motors are supplied with energy from special windings on the transformer cores. The air ducts supplying each bank may be connected if one motor fails to operate, as the other blowers will supply sufficient air. No connections between transformers are exposed. They are inclosed in asbestos compartments on the walls above the transformers. The transformer disconnecting switches are also installed in wall compartments, while pilot lamps indicating when their respective transformer banks are energized are fastened to wall panels.

The station was designed under the supervision of Mr. Thomas E. Murray, first vice-president of the company, and the construction has been under the direc-

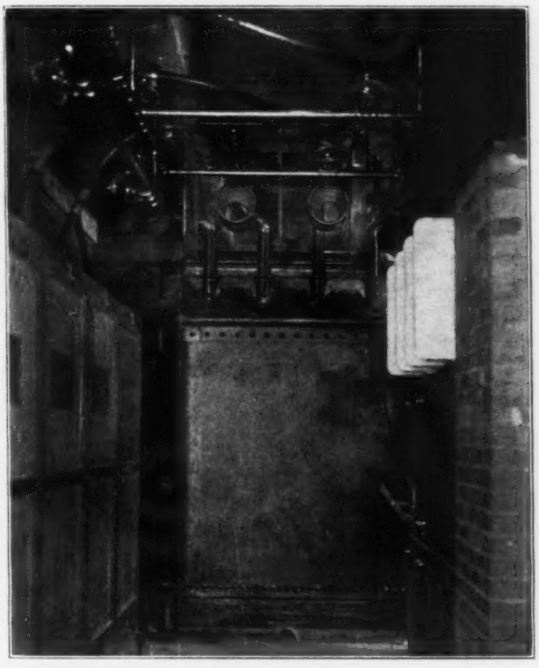


FIG. 18—30,000-VOLT TESTING TRANSFORMER

tion of Mr. W. E. McCoy, electrical engineer. The other officials of the United company are: President, Mr. Nicholas F. Brady; second vice-president and general manager, Mr. Frank W. Smith; secretary, Mr. Lewis B. Gawtry; assistant secretary, Mr. Lawrence A. Coleman; treasurer, Mr. Benjamin Whiteley. The sales department is under the direction of Mr. Joseph F. Becker, sales manager, the 201st Street station being under the immediate direction of Mr. H. W. Leitch, electrical superintendent, and Mr. William McDonald, chief engineer. All feeder and distributing panels for both motor and lamp circuits were furnished by the Metropolitan Engineering Company, Brooklyn, while the conduit work for these circuits was installed by L. K. Comstock & Company, New York City.

The New Edison Building in Chicago

The Commercial National Bank Building, at the northeast corner of South Clark Sereet and West Adams Street, Chicago, which was purchased some time ago for the Commonwealth Edison Company, will be known as the Edison Building after May 1 of this year. At that time, or about that time, a large portion of the officers and office employees of the Commonwealth Edison Company will transfer their offices from the present offices at 120 West Adams Street to the new building. The Commonwealth Edison Company will occupy nearly all the space in the building from the ground floor up to and including the seventh floor, and also space in some of the upper floors. A considerable proportion of the building will be rented to tenants, including a number of electrical concerns. The building has a large ground area and is eighteen stories high.

Power Equipment of the Robert B. Brigham Hospital at Boston

Although the Robert B. Brigham Hospital, Boston, Mass., is situated on the summit of Parker Hill, the power plant is placed under the brow of the hill out of sight and hearing of the main buildings, the high smokestack being the only part visible. Communication between the plant and the hospital is obtained through a long tunnel which runs nearly horizontally from the upper part of one building to the basement of the other. This tunnel is large enough to contain all the necessary heating pipes and the mains for the distribution of electrical energy, and it provides a passage for the various attendants of the mechanical department.

The equipment of the power house consists of three Babcock & Wilcox boilers, fired by automatic stokers, which supply steam to three 62.5-kva Terry turbo-generators. The generators are three-phase, sixty-cycle, 220-volt machines made by the Allis-Chalmers Company. The turbines are non-condensing and deliver their exhaust directly to a Warren-Webster vacuum-heating system. In severe weather, when the exhaust from the turbines is not sufficient for heating, live steam is added to the system through a reducing valve. The turbo-generators supply energy to the laundry and kitchen motors, the refrigerating apparatus, two motor-driven pumps which raise water from the city mains to the pressure tanks supplying water to the entire hospital, individual motors for special purposes, and for lighting all the buildings.

On account of the lack of easy means of communication between the plant and the structure it serves, everything possible was done to insure continuous service in the equipment. The boiler capacity is generous and a spare generating unit has been provided. In order not to disturb the hospital patients by smoke, the stack was placed 100 yd. away from the power plant and at a much higher elevation. The foot of the stack is reached by underground ducts. Densmore & Le Claire were the architects and engineers.

Parallel Operation of Transformers—II

Methods of increasing the output of a group of transformers and a numerical problem to determine the current in each unit. By Waldo V. Lyon

A THEORETICAL discussion of the operation of transformers in parallel was given in the *Electrical World* of Feb. 7. The conclusion of the theoretical exposition, together with a numerical example, is given herewith.

The final step in the analysis is to determine the effect that the components have on the total output of the transformers. It is probable that no simple statement can be formulated for the general case in which the ratios of transformation are unequal. If the ratios are equal, however, the solution is readily determined. In this case, the current in any transformer, n, is:

$$I_n = \frac{y_n}{Y_o} I_o$$

Assume that the condition of load is such that this transformer is taking its maximum allowable current, I_n', and that all of the other transformers are not fully loaded. The common equivalent impedance drop through the transformers is then equal to $\frac{I_n'}{y_n}$ and the total load current is:

$$I_o = \frac{Y_o}{y_n} I_n' \qquad (9)$$

Therefore the greatest current that can be safely supplied by a group of transformers connected in parallel is equal to the maximum allowable current of the transformer which has the least equivalent impedance drop at full load multiplied by the ratio of the combined parallel equivalent admittance of all of the transformers to the equivalent admittance of this particular transformer. This is true for any case except where the ratios of transformation are not the same for all of the transformers.

It often happens that the ratios of equivalent resistance to equivalent reactance are nearly alike. If this is the case a very good approximation to the permissible output as given by equation (9) is:

$$I_o = \Sigma y (I_n' z_n)$$

The greatest permissible current output is equal to the algebraic sum of the equivalent admittances multiplied by the smallest full-load equivalent impedance volts.

The combined output of a group of transformers connected in parallel can be increased in two ways: first, by adding reactors in series with each transformer circuit so that the resultant equivalent impedance drops are the same for all of the transformers when they carry their maximum allowable currents, and, second, by modifying the equivalent impedance of each transformer so that the ratios of the equivalent resistance to the equivalent reactance are the same for all of the transformers. The latter is, of course, only a hypothetical change.

Assume that, in order to increase the permissible output of the group, reactors are added in series to all of the transformers but one so that each will have the same equivalent impedance drop with the maximum allowable current. The one which has no added reactor is obviously that with the greatest equivalent impedance volts for maximum allowable current.

$$\frac{I_1'}{y_1'} = \frac{I_2'}{y_2'} = \quad . \quad . \quad . \frac{I_p'}{y_p}$$

I_1', I_2', etc., are the maximum allowable currents as before. y_1', y_2', etc., represent the resultant admittances of the transformers and added reactors. The transformer p is the one whose admittance has not been changed.

Under this new condition the total current output is:

$$I_o' = \frac{Y_o'}{y_p} I_p'$$

Y_o' is the combined admittance of the transformers and reactors under the new condition. The ratio of this current to its original value—see equation (9)—is:

$$\frac{I_o'}{I_o} = \frac{[Y_o']}{[Y_o]} \frac{[I_p' z_p]}{[I_n' z_n]} \qquad (10)$$

In practice it is sufficiently exact to say that the transformers will deliver their total output if reactors are added to all but one of them so as to make their resultant full-load-equivalent impedance volts the same. If this is so, a good approximation to equation (10) is

$$\frac{\Sigma I'}{\Sigma y\ (I_n' z_n)}$$

n denotes the transformer with the smallest equivalent impedance volts.

The second method of increasing the combined output of a group of transformers is by making the ratios of the equivalent resistance to the equivalent reactance the same for all of the transformers without altering the numerical value of any equivalent impedance. This is of course practically impossible, and it is only stated in this way to separate the results accomplished by the two methods. The value of the greatest load current is given in equation (9). If now the ratio of equivalent resistance to equivalent reactance is made the same for all of the transformers without changing the actual value of any equivalent impedance, the sum of the admittances in complex notation is numerically equal to the sum of their numerical values, that is, Σy. Therefore by making the ratio of equivalent resistance to equivalent reactance the same for all of the transformers their combined output is multiplied by the ratio of the algebraic sum of the equivalent admittances to the numerical value of their sum in the complex notation.

It is interesting to estimate the amount by which the combined output of a group of transformers may be increased by each of the methods mentioned. In order to separate the effects it will be assumed that in the case where the equivalent impedance drops are not the same for all of the transformers the ratios of equivalent resistance to equivalent reactance are the same for all, both before and after impedance units are added to some of the transformers. In the second case it will be assumed that the equivalent impedance drops at full load are the same for all and that only the distribution between equivalent resistance and equivalent reactance is altered.

Where it is a question of the equivalent impedance

drops not being equal at full load, the worst condition that can arise is when they are the same for all but one transformer and for that one the drop is less than in the others. If this be so, all of the transformers but one will be carrying a certain fraction, $\frac{1}{K}$, of their maximum allowable current when this one is fully loaded. If the rated output of the transformer which has the low value of equivalent impedance drop is small compared with the combined outputs of the others the total output will be increased approximately K-fold if the impedance of this one is properly adjusted. As the equivalent impedance drop may vary from, say, about 3 to 9 per cent of the rated voltage, it might be possible to increase the total output by as much as about 200 per cent by making the equivalent impedance drops the same for all of the transformers.

In the case of equal equivalent impedance drops but of unequal ratios of equivalent resistance to equivalent reactance the maximum amount by which the load can be increased is very small. The worst condition that can arise is where transformers with a combined rated output equal to one-half of the total have the same ratio of equivalent resistance to equivalent reactance, which ratio is a minimum, and the other half likewise have

NUMERICAL DATA RELATING TO GROUP OF TRANSFORMERS

	(1) Core Type	(2) Shell Type	(3) Shell Type
Rating, kva	500	500	1,000
Rated voltage:			
High-tension	11,000	11,000	11,000
Low-tension	2,300	2,300	2,300
Turns:			
High-tension	746	344	278
Low-tension	156	72	58
Short-circuit data:			
Volts	345	288	539
Amp.	45.5	45.5	91.0
Watts	3,375	4,680	7,490

the same ratio of equivalent resistance to equivalent reactance, which ratio is a maximum. In transformers of large sizes the ratio of equivalent reactance to equivalent resistance may vary from about 2:1 to about 6:1. In this case the total current will be divided into two equal components, one of which makes an angle of $\tan^{-1} 2$ and the other angle of $\tan^{-1} 6$ with an axis of reference. Thus the angle between these two components is approximately 17 deg. The fractional increase in the total load that can be carried by readjusting the equivalent resistances and the equivalent reactances so that they are in the same ratio for all of the transformers is

$$\frac{1}{\cos\left(\frac{17^\circ}{2}\right)} - 1 = 0.011$$

In transformers of small rated output the ratio of equivalent reactance to equivalent resistance may vary from about 1:2 to about 2:1. In this case the angle between the components is

$$(\tan^{-1} 2. - \tan^{-1} 0.5) = 37 \text{ deg.}$$

The maximum fractional increase in the load that could be obtained would then be

$$\frac{1}{\cos\left(\frac{37^\circ}{2}\right)} - 1 = 0.05$$

Thus, compared with the effect of unequal equivalent impedance drops, the effect of unequal ratios of equivalent resistance to equivalent reactance is negligible.

It only remains to give an illustration of how this method of analysis would be applied in practice. The transformers which are used for this purpose are hypothetical ones but their constants are within the limits of what is met in practice. In fact, they have the same per cent equivalent impedance volts and the same ratio of equivalent resistance to equivalent reactance as do some actual transformers. They have been chosen to show what will be the result if dissimilar transformers are operated in parallel.

The problem is to determine the current in each transformer when they take a combined load of 2000 kva at 0.90 power-factor from an 11,000-volt circuit. The load will be considered inductive. The ratios of transformation are given by the ratios of turns and are:

$$a_1 = 4.781$$
$$a_2 = 4.778$$
$$a_3 = 4.794$$

The numerical values of the equivalent admittances are given by $\left(\frac{I}{E}\right)$ at short circuit. The equivalent conductances are given by $\left(\frac{P}{E^2}\right)$.

$$y_1 = 0.1318 \qquad g_1 = 0.02835$$
$$y_2 = 0.1580 \qquad g_2 = 0.05642$$
$$y_3 = 0.1688 \qquad g_3 = 0.02578$$

The equivalent susceptances are given by $\sqrt{y^2 - g^2}$, which in this case can be approximated by the formula

$$b = y - \frac{1}{2}\frac{g^2}{y}$$

$$b_1 = 0.1286$$
$$b_2 = 0.1480$$
$$b_3 = 0.1668$$

The complex expressions for the equivalent admittances may now be written:

$$y_1 = 0.02835 - j\,0.1286$$
$$y_2 = 0.05642 - j\,0.1480$$
$$y_3 = 0.02578 - j\,0.1668$$

From these expressions the joint parallel equivalent admittance is found by addition.

$$y_o = 0.1105 - j\,0.4434$$

In order to find the value of the expression Σay, each equivalent admittance is multiplied by the corresponding ratio of transformation and the results added.

$$a_1 y_1 = 0.1355 - j\,0.6150$$
$$a_2 y_2 = 0.2696 - j\,0.7072$$
$$a_3 y_3 = 0.1236 - j\,0.8000$$
$$\Sigma ay = 0.5287 - j\,2.122$$

The total current, I_o, is $2{,}000{,}000 \div 11{,}000 = 182$ amp. It is preferable to take this current as along the axis of reference so that its complex expression is:

$$I_o = 182 + j0$$

If the current is taken along the axis, the complex expression for the primary coltage, V_1, is

$$V_1 = 9900 + j\,4795$$

In the equation (3) for the complete value of the current there are the expressions $\left(\frac{I_o}{\Sigma ay}\right)$ and $\left(\frac{V_1 Y_o}{\Sigma ay}\right)$ that are constant.

$$\left(\frac{I_o}{\Sigma ay}\right) = \frac{182 + j\,0}{0.5287 - j\,2.122} = 20.14 + j\,80.9$$

$$\frac{V_1 Y_o}{\Sigma ay} = \frac{(9900 + j\,4795)\ \ (0.1106 - j\,0.4434)}{0.5287 - j\,2.122}$$

$$= 2067 + j\,1002$$

We can now calculate the currents in each of the transformers by equation (3)

$$I_1 = (0.1355 - j\,0.6150)\ (20.14 + j\,80.9) + (0.02835 - j\,0.1286)\ (9900 + j\,4795 - 4.781\ (2067 + j\,1002))$$

$$I_1 = 53.1 - j\,1.9$$

$$= 53.1 \text{ amp}$$

$$I_2 = (0.2696 - j\,0.7072)\ (20.14 + j\,80.9) + (0.05642 - j\,0.1480)\ (9900 + j\,4795 - 4.778\ (2067 + j\,1002))$$

$$I_2 = 64.3 + j\,6.3$$

$$= 64.6 \text{ amp}$$

$$I_3 = (0.1236 - j\,0.800)\ (20.14 + j\,80.9) + (0.02578 - j\,0.1668)\ (9900 + j\,4795 - 4.794\ (2067 + j\,1002))$$

$$I_3 = 65.4 - j\,4.5$$

$$= 65.6 \text{ amp.}$$

The sum of the currents is

$$182.8 - j\,0.1$$

The errors in the calculation thus amount to about 0.5 per cent, but considerable care must be exercised in finding the value of the second term in the equation for the current in order to check as closely as this.

Assume now that the ratios of transformation are equal. The currents are then determined by equation (1).

$$I_1 = \frac{(0.02835 - j\,0.1286)}{(0.1106 - j\,0.4434)}\ (182 + j\,0)$$

$$I_1 = 52.4 - j\,1.5$$

$$= 52.4 \text{ amp}$$

$$I_2 = \frac{(0.05642 - j\,0.1480)}{(0.1106 - j\,0.4434)}\ (182 + j\,0)$$

$$I_2 = 62.6 + j\,7.5$$

$$= 63.1 \text{ amp}$$

$$I_3 = \frac{(0.02578 - j\,0.1668)}{(0.1106 - j\,0.4434)}\ (182 + j\,0)$$

$$I_3 = 66.9 - j\,6.1$$

$$= 67.2 \text{ amp.}$$

In this case a variation of about 0.2 per cent from the average ratio of transformation makes an average difference of about 2 per cent in the currents. Such variations in the ratio of transformation are not important, as the variations in the current that they produce are about within the error of the method of calculation.

The components, B, in the several transformers are

$$B_1 = 0.7 - j\,0.4$$
$$B_2 = 0.7 - j\,0.8$$
$$B_3 = -1.5 + j\,1.6$$

The sum of these components is not zero, owing to the errors in the calculations. The greatest error that would be introduced by assuming equal ratios of transformation is in the case of the third transformer, where the current would be about 2 per cent too large. If the ratios of equivalent resistance to equivalent reactance had been the same for all the transformers, the currents would have been given by equation (4) as:

$$I_1 = \frac{0.1318}{0.4586}\ (182 + j\,0)$$

$$I_1 = 52.5 + j\,0$$

$$I_2 = \frac{0.1580}{0.4586}\ (182 + j\,0)$$

$$I_2 = 62.9 + j\,0$$

$$I_3 = \frac{0.1688}{0.4586}\ (182 + j\,0)$$

$$I_3 = 66.5 + j\,0$$

$$\Sigma y = 0.1318 + 0.1580 + 0.1688$$

$$= 0.4586.$$

The components C in the several transformers are given by equation (5) as:

$$C_1 = -0.1 - j\,1.5$$
$$C_2 = -0.3 + j\,7.5$$
$$C_3 = +0.4 - j\,6.1$$

The greatest error introduced by making the assumption of equal ratios of equivalent resistance to equivalent reactance is about 1 per cent in the current in the third transformer.

If the transformers had had equal equivalent impedance drops at their rated output, the currents in the several transformers would have been given by equation (6) as:

$$I_1 = \left(\frac{45.5}{182}\right)(182) = 45.5$$

$$I_2 = \left(\frac{45.5}{182}\right)(182) = 45.5$$

$$I_3 = \left(\frac{91}{182}\right)(182) = 91$$

The components D in the several transformers are given by equation (7) as:

$$D_1 = 7.0$$
$$D_2 = 17.4$$
$$D_3 = -24.5$$

These then are the components of the currents which are most important and are the only ones that need serious consideration. For this load the first two transformers are considerably overloaded, while the third is operating at only 73 per cent of its rated output.

The maximum total load that these transformers will deliver is determined by the second one, since it has the smallest equivalent impedance volts at full load. This maximum load is given by equation (9) and is

$$I_o = \left(\frac{0.4571}{0.1580}\right)(45.5)$$

$$= 131.6 \text{ amp}$$

$$[0.4571 = Y_o]$$

This is 72.2 per cent of their combined rated outputs. If the equivalent impedance volts at full load are made equal by adding reactors to the first and second transformers, their combined permissible output can be increased by about 550 kw.

If the ratios of equivalent resistance to equivalent reactance had been the same, the output would have been

$$\frac{0.4586}{0.4571}\ 131.6 = 132.$$

This makes a negligible change in the output.

In general, it appears that a good degree of approximation will be attained if it be assumed that the ratios of transformation are equal and that the ratios of equivalent resistance to equivalent reactance are the same for all of the transformers.

Versatile Electrical Devices

To the member of the Philadelphia Electric Company Section of the National Electric Light Association naming the greatest number of electrical devices and the greatest number of practical uses to which these appliances could be put an award known as the John Meyer prize was recently offered. At the close of the contest Mr. R. L. Lloyd was named winner, having enumerated 193 appliances, of which seven have twenty-four practical applications. Honorable mention was accorded to Mr. R. B. Ely, who enumerated 116 appliances, of which ten have twenty practical uses, and to Mr. Daniel A. Fitzgerald, who presented a list of 175.

The Silver Voltameter—Part IV

BY E. B. ROSA, G. W. VINAL AND A. S. MCDANIEL

In the three papers preceding this one* the course of the work has been traced from its beginning in 1908 until the International Technical Committee met in Washington in April, 1910, to carry out a joint investigation of the voltameter and to determine the voltage of the Weston normal cell in terms of the international ohm and the international ampere, the latter being derived from the silver voltameter. The object of the present work was to make a further comparison of the porous cup and Smith forms of voltameter, since these had been found the most reliable forms during the committee's work, and to make such other experiments as might afford data for the voltameter specifications not yet adopted.

The international committee fixed the voltage of the cell to five significant figures (1.0183 volts at 20 deg. C.), but it is desirable to reach an accuracy sufficient to justify recording six figures, since the voltameter is a primary standard. Results are expressed as the voltage of the normal Weston cell at 20 deg. computed from the defined electrochemical equivalent of silver, 1.11800 mg per coulomb.

The procedure was according to the best methods learned from previous work. In all cases the electrolyte was carefully tested for its purity and the acidity determined. The voltameters used were chiefly the porous pot and Smith's form, but on several occasions the siphon form was used as well as the modified ring-shaped siphon and the Poggendorff form.

Since it was learned from previous work that the effect of acid in pure electrolyte is to lower the deposit, the authors sought to find, if possible, a quantitative relation between the amount of acid expressed in equivalents of HNO_3 per million (X) and the decrease in deposit also expressed in parts per million (Y). As a result of a large number of comparisons of neutral voltameters with others made acid by varying amounts, the following relation has been found

$$Y = -4.5\,X + 0.02\,X^2$$

which, it is thought, is justified by the figures given in the complete paper.†

For acidities below ten parts per million the square term is of course unnecessary. The above equation was used in computing a correction to each deposit, but this correction was very small in all cases for the results given below. The result of 156 deposits in the porous cup form is 1.01826_7 volts. The average deviation of a single observation from the mean is 0.00003_6 and the computed probable error of a single observation is 0.00002_5. The probable error of the mean result is 0.00000_2.

The result of fifty-five deposits in the Smith form is 1.01827_4 volts. The average deviation of a single observation from the mean is 0.00004_0 and the computed probable error of a single observation is 0.00003_4. The probable error of the mean result is 0.00000_5.

The mean of the porous-pot form and the Smith form is therefore 1.01827 volts, which is given as the final result. The electrolyte was so pure that no volume effect was observed in either form of voltameter.

With other forms of voltameter the following results have been obtained: Siphon form (relative experiments, five observations), 1.01832; modified siphon (seven observations), 1.01835; Poggendorff form (nine observations), 1.01830. The results with five forms of voltameter all confirm the decision of the international committee, but the difficulties arising from the anode slime in the last two make them more uncertain and difficult to use. The siphon voltameter requires so much electrolyte that the presence of the slightest trace of impurity increases the "volume effect" noted previously in several other forms.

A number of miscellaneous observations were made on the effect of various impurities, but mention need only be made here of the excessive deposits obtained when considerable CO_2 is present in the atmosphere above the voltameters. Two possible theories are given in the complete paper to account for the slight difference occasionally appearing in the deposit between the Smith form and the porous-cup form.

A further study of the effect of acid on solutions known to be impure has shown the effect to be quite variable, depending on the nature of the impurity. This fact, it is believed, accounts for much of the conflicting opinion found in the literature on this subject. The authors have endeavored to find just what the action of acid is by which it reduces the deposit from pure electrolyte, but the results obtained by them are chiefly negative. It seemed possible that in the case of an electrolyte appreciably acid the decrease might be due to a depositing out of the hydrogen ions before the silver begins to deposit, since there is probably at the instant the current begins to flow a greater difference of potential at the cathode than obtains later, as the discontinuous character of the deposit indicates that the potential difference must break through a sort of surface film and establish outlets for the current to the platinum cathode. If this were possible, by making deposits of about 1 mg each from solutions containing acid and without acid the difference ought to be apparent. This the authors have done for varying lengths of deposit, measuring the silver by titration with ammonium sulphocyanate. The results showed always an agreement of both deposits between themselves and with the computed value for the silver within the experimental error. But when oxygen was electrolyzed into the platinum cathode for four hours previous to making a deposit a loss of about 0.2 mg was observed. This was not again found on subsequently using the bowl unless it had been oxygenated as before.

A careful study was made of the effect of various septa other than filter paper on the voltameter. First raw silk was investigated. In extracting raw silk in neutral double distilled water it was found that the extract was distinctly basic toward iodeosine and the concentracted extracts will restore the color to a magneta solution previously decolorized by sulphurous acid, thus indicating the presence of an aldehyde. The approximate turning point of iodeosine in ether water solution has been determined to be at $[H+] = 10^{-6}$. The colloidal character of the solutions was ascertained by the ultra-microscope. After prolonged washing or use in the voltameter the so-called "silk glue" which probably gives rise to the above effect is eliminated and a hydrolytic process into amino acids becomes predominant, causing a reverse action in the voltameters. The authors have never claimed that these two actions are evident at the same time, as implied recently by von Steinwehr, and think that silk like filter paper should be excluded from use in the silver voltameter.

The experimental evidence indicates that porous pots, if properly prepared, are without influence on silver nitrate. A new pot or one that has been baked may contain free alkali which must be washed out with nitric acid and water until perfectly neutral and then several portions of silver nitrate filtered through the pores until the equilibrium between the pot and solution is ob-

*"The Silver Voltameter," Part I, *Electrical World*, Dec. 14, 1912, page 1261; Part II, Dec. 14, 1912, page 1262; Part III, Jan. 11, 1913, page 84.

†Von Steinwehr's recently expressed opinion to the contrary (*Instrumentenkunde*, November, 1913) was based on earlier work which was not so conclusive as our recent work.

tained, since at the beginning the pot may act as a catalyzer, to reduce a very small amount of solution. After being properly prepared there is no evidence of stenolysis or other abnormality in the ordinary use.

The question of the purity of the deposited silver is an important one, but the conflicting evidence in the literature does not enable one to decide even whether inclusions are present or not. The uniformity of the results obtained in three series of experiments suggests that the inclusions must be very small or surprisingly constant in amount. It seems that inclusions, if present, would be between crystals rather than in a crystal perfectly formed according to the cubic system, and hence greater inclusions are to be expected in deposits which are less crystalline because of the action of colloids.

An endeavor has been made to detect the presence of $AgNO_3$ in the deposits by amalgamating them with mercury, then washing the amalgam and testing for nitrates by phenol sulphonic acid. The blank experiments, adding $AgNO_3$ to the amalgam after precipitating any mercury and silver salts present, worked satisfactorily, but no appreciable $AgNO_3$ in the best deposits has been detected, although a trace was found in striated deposits. If considerable filter paper was used, some organic matter was visible after amalgamating the deposit. The authors tried to determine the water content of a striated deposit having an excess weight over a normal deposit of 0.56 mg by alloying the deposit to the platinum crucible in which it was made over an alcohol blast, and found a loss of 0.53 mg which previous experiment showed was not due to the change in the platinum crucible alone. Inasmuch as no further experiments were made the result is not considered conclusive.

The reactions in the voltameter have not generally been considered as reversible—that is, an equivalence of the loss in weight at the anode and gain at the cathode—but since previous work had shown that the supposed complex reactions at the anode do not probably exist, the possibility of reversibility was examined. For an anode a heavy deposit contained in a large platinum bowl was used and the electrolyte connected in this through a siphon to a second bowl serving as cathode. First, the progressive change in acidity of the anode solution was measured as electrolysis took place and it was found that practically no change of acidity occurs until the silver on the anode was reduced to about 0.5 gram, after which it rose very abruptly. Next the potential difference between the anode and an intermediate electrode was measured, and this was also found to be constant until about 2.5 grams of silver remained. The question was then examined quantitatively, with the results shown in the accompanying table.

The results show a surprising agreement. These were made using a pure crystalline deposit for the anode. With a striated deposit made from a filter paper contaminated solution the result was very different. The anode turned dark and had a very large amount of slime, all of which was collected and added to the bowl. The results from using a pure solution and this impure anode are as follows:

Anode lost	2095.43 mg
Cathode gained	2092.21 mg
Standard voltameter	2091.83 mg

The conclusion leaves no room for doubt that the purity of the anode is essential in such an experiment, and this should be considered in voltameter work in general.

The authors have added to the complete paper a further discussion of the volume effect (see Part III) in reply to von Steinwehr's criticisms (*Zeit. f. Instr.*, November, 1913) and have shown that this phenomenon of excess deposit in large bowls over small bowls, when impure electrolyte is used, is not confined to the porous-cup form, as von Steinwehr asserts, but has been observed in the filter paper form by Schuster and Crossley and in the siphon and Smith forms by ourselves. This troublesome volume effect has been overcome by purifying the electrolyte. Great stress is placed on the purity of the electrolyte used in obtaining the results

QUANTITATIVE RESULTS OF EXPERIMENT

Weight of Silver on Anode Bowl, Grams	Current, Amp	Loss at Anode, Mg	Gain at Cathode, Mg	Deposit in Standard Voltameter, Mg
8	0.500	2164.81	2164.78	2164.81
9	0.500	2092.12	2091.92	2091.83

recorded. This question of the purity of the electrolyte has received less attention from previous observers than it deserves. The methods for purifying silver nitrate have been described in Part III of this series of papers.

Moderate Power Requirements of Automobile Lighting Outfits

At the meeting of the Detroit-Ann Arbor Section, A. I. E. E., held at Detroit, Mich., recently Prof. Benjamin F. Bailey, University of Michigan, read a paper on "The Electrical Equipment of the Gasoline Automobile," describing types of electric generators and cranking motors used on automobiles and comparing their characteristics of efficiency, reliability and limitations in design. Data were also presented to disprove assertions which have been made that electric-lighting outfits increase the fuel consumption of automobile engines from 10 to 12 per cent.

On a road test conducted by Professor Bailey it was found that the mileage per gallon of gasoline of a 1700-lb. automobile was reduced only 2 per cent at the most by connecting a lighting generator to the engine. Another experiment made by alternately connecting and disconnecting the automobile engine to a fully loaded lighting generator while the car was running at a definite speed failed to show any appreciable change in the speed of the car.

Several members of the Society of Automobile Engineers took part in the discussion which followed.

Mr. A. H. Knight assistant engineer Packard Automobile Company, Detroit, corroborated Professor Bailey's findings by saying that the Packard company was unable to detect any change in mileage per gallon of gasoline even after making 200-hour tests on gasoline engines with and without the lighting equipment attached. Experiments conducted on the Indianapolis (Ind.) Motor Speedway also failed to reveal any appreciable increase in fuel consumption due to the generator load.

Mr. H. L. Connell described briefly a new electric gear-shift which is just being placed on the market. With this new device, it is declared that about forty-five gear movements can be made with an expenditure of only 1 amp-hr. of electricity at 6 volts.

Mr. W. H. Conant, Gould Storage Battery Company, New York City, discussed battery life and explained how it may be increased. He said that prolonged overcharging at high rates causes rapid deterioration of a battery by overheating the plates.

Messrs. J. O. Heinze, chief engineer Northway Motor Company, and J. G. Vincent, Packard Automobile Company, also took part in the discussion.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Growth of Electric Service in Muskogee, Okla.

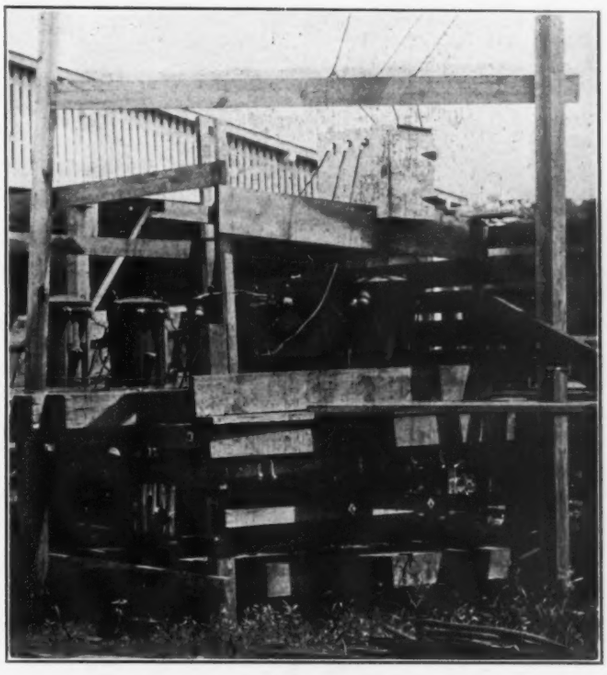
In the period of seven years that elapsed from Jan. 1, 1907, to Jan. 1, 1914, the population of Muskogee, Okla., increased about 50 per cent, whereas the number of electric-service customers of the Muskogee Gas & Electric Company increased 173 per cent. The lighting load increased from 949 kw to 4021 kw in the seven years, showing a growth of 323 per cent. The motor load increased from 478 hp to 2453 hp, a growth of 413 per cent. The total connected load of all kinds was slightly over 6000 kw at the end of 1913. There were seventeen inhabitants per electric-service meter in 1907, compared with nine and one-third inhabitants seven years later. It is interesting to note that the number of inhabitants per gas meter on Jan. 1, 1914, was five and two-fifths. The Muskogee property is managed by H. M. Byllesby & Company.

Selling Electrically Irrigated Farms in California

From Mr. A. J. Rosborough, general manager of the California-Oregon Power Company, San Francisco, Cal., an interesting account has been received of the application of electric pumping to the irrigation problems of the neighboring country. Mr. Rosborough's letter reads in part as follows: "One great factor in the development of electricity on the Pacific Coast is its use for electric pumping and other farm service. During the year 1913 two projects were started in northern California for the subdivision of large tracts of land, formerly used for stock grazing, into farms of from 40 acres to 140 acres each. The company undertaking these projects set about them in a very businesslike manner. First the land was plowed and sown to alfalfa; then two large electrically driven pumps were installed, one of sufficient size and capacity to lift the water 85 ft. into a main ditch, which with laterals fed an area of over 3000 acres, the other pump being employed to lift water another 65 ft., supplying irrigation to an additional 1500 acres. After this the company purchased blooded hogs and began breeding them, and the farms were opened to settlement. The settler had his choice of location and the company fenced in the section selected, built a house and barn, wiring both for electricity, delivered the required number of hogs, and took a small initial payment, selling the land at a moderate price. The farmer was thus put on a paying basis at the start and furnished with a possible source of steady income. This year the same company intends to put 8000 acres under irrigation and to sell it in a similar manner. In one of the adjoining valleys 20,000 acres are being cleared and subdivided and will be sold on a like plan, and there are other projects of this nature under way." The California-Oregon Power Company supplies the energy for much of this summer pumping and, according to Mr. Rosborough, it plans to build up a corresponding load for the winter months, consisting of electrical heating and the operation of agricultural machinery.

Prompt Emergency Service Secures New Business

The accompanying illustration shows a temporary bank of six small transformers hastily collected and installed by a Southern central-station company to furnish 275 hp of emergency motor service to a local lumber mill when the latter's isolated plant burned. As a result of the prompt emergency service thus rendered



TEMPORARY BANK OF SMALL TRANSFORMERS FURNISHING SERVICE TO LUMBER MILL

the central-station company shortly afterward secured a contract for supplying all of the energy used in the lumber mill, and the burned isolated plant was never replaced.

What One Information Bureau Does

At a recent meeting of the Commonwealth Edison Company Section of the N. E. L. A. Mr. W. R. White gave some rather interesting information about the work of the information bureau of that company. This department answers both inquiries at the information window on the ground floor of the company's headquarters building and questions that come over the telephone. It also handles the incoming and outgoing United States mail and maintains a messenger service between the various office buildings, stations, substations, garages, warehouses, etc., of the company scattered all over the city. About 600 inquiries are answered each day. The outgoing mail is put through a motor-driven machine called the "mailometer," by which letters are sealed, stamped and counted. An average of about 6000 pieces

of outgoing mail are thus handled daily, although as many as 9000 have been sent out in one day. The incoming letters are opened by a motor-driven machine which saws off the ends of the envelopes. Often 5000 or more of the incoming letters handled daily contain checks. About 6000 pieces of inter-department mail are handled by messengers each day.

An Appropriate Central-Station Office Sign

Before its main office and pay stations the Malden (Mass.) Electric Company employs an appropriate form of electric sign which, as illustrated in the accompanying photograph, emphasizes the company's readiness to supply lighting service. At the main office the sign of incandescent-lamp shape used measures about 6 ft. long and 30 in. high, and is bordered with forty-six 5-watt,

CENTRAL-STATION SIGN USED BY MALDEN (MASS.) ELECTRIC COMPANY

11-volt frosted lamps on each side. Signs about half this size are suspended over the entrances of the company's collection agencies. This similarity of emblems employed in the various localities served by the company has been found to be of excellent advertising value.

Municipal Plant to Purchase Energy

The Minnesota-Wisconsin Power Corporation, a subsidiary of the American Public Utilities Company, of Grand Rapids, Mich., has closed a contract with the municipality of Lake City, Minn., for furnishing the local municipal plant with energy for light and motor service. The Minnesota-Wisconsin Power Corporation has also completed arrangements to furnish the towns of Prescott and Hastings, Minn., with electricity.

The Red Wing Gas, Light & Power Company, a subsidiary, has contracted for the city pumping at Red Wing. The pump installed will supply approximately 2,000,000 gal. of water a day.

Methods of Displaying Fixtures in Electric Shop

The new salesrooms just opened at Jackson, Mich., by the Commonwealth Power Company have been specially equipped to display the merits of individual fixtures. Where formerly only two rooms were devoted to the exhibit of appliances and fixtures, three

FIG. 1—FIXTURE DISPLAY ROOM, SHOWING HOW CEILING PIECES ARE SUPPORTED

connecting rooms are now used, each having about 400 sq. ft. of floor area. One room is employed exclusively for the exhibition of ceiling and wall fixtures, while the other two contain cooking utensils and other electric household appliances in addition to pendent fixtures.

The two last-mentioned rooms, as shown in Fig. 1, are separated from each other by only a low oak partition which is capped on each side of the connecting passage by columns of the same material. The rest of the woodwork is also a dark-stained oak. Around the sides of the two appliance rooms are open wallcases.

FIG. 2—FIXTURE DISPLAY ROOM, SHOWING PORTABLE DISPLAY PANELS

The heavy oak slabs forming the top of these cases support various appliances which are demonstrated in action by connecting them with plug receptacles in the wall. Beneath the slabs are spaces which are open to the view and are used to hold apparatus which does not ordinarily require to be demonstrated in order to be sold.

The ceilings of each room are divided by heavy oak strips into bays 33 in. wide and 44 in. long. At each intersection in this lattice-work are ceiling outlets and hooks for supporting pendent fixtures. The fixtures are fastened to the hooks by insulating joints and are connected with the service outlets through split-plug connectors. With this method of suspension a fixture can be easily removed from its support for examination or for replacement. Although 107 fixtures are suspended from the ceilings, the crowded appearance usually existing in appliance rooms is absent here.

Special pains have been taken to give the rooms a homelike appearance by the proper choice of furnishings. In the center of each room is a library table and on it a table lamp. Care is taken in choosing the central ceiling fixture as it is kept lighted all the time and is therefore most prominent. Plenty of chairs are available in each room for the use of prospective customers who may remain seated while the fixtures are being shown. Luminous heaters are kept burning where they are in full view of persons entering the rooms, and give a warm, homelike glow to the place.

FIG. 3—PORTABLE DISPLAY PANEL

For displaying wall fixtures eighteen portable panels like the one shown in Fig. 3 are used. A detailed description of one of these appeared in the issue of the *Electrical World* for Nov. 29, 1913. These display boards, it is declared, have brought better results in disposing of old stock than any other scheme which the company has tried in the last few years.

Opening off from the salesrooms are a stockroom and a fixture-assembling room which adjoin. The storeroom is spacious and the stock is stored systematically so that extra fitings may be obtained readily.

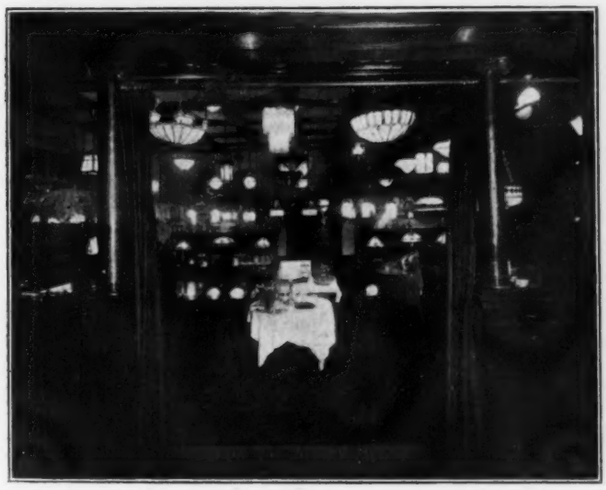


FIG. 4—DISPLAY ROOM, SHOWING WALLCASES

When an order for a large number of fixtures is to be furnished by this company they are ordered in parts from the manufacturer and assembled in the room adjoining the stockroom.

Mr. C. L. Falkinberg, who is head salesman for the Commonwealth company, devised the methods of displaying fixtures described above.

Merchants' Associations Install and Operate Ornamental Lighting at Davenport, Ia.

When ornamental street lighting is to be installed, some scheme of co-operation among the merchants of the district to be improved can usually be carried out with considerable success. At Davenport, Ia., the electric-service company has gone even a step further with this policy, and after the merchants' associations have been formed for the purpose of erecting ornamental lighting units and have accomplished their purpose the organization is kept intact to maintain the installations. Officers of the associations are elected regularly, the principal official being the secretary. Through him the electric company deals with the organization, and thus ornamental street lighting is billed from the company's books in portions no smaller than one city block.

As rapidly as a group of merchants in any block of the city is ready for ornamental lighting, associations are formed to deal with the company. Under contracts now in force the lamps are lighted from dusk till 10 o'clock six nights of the week, and on Saturday until midnight. The charge for energy and maintenance of five-lamp clusters, where there are sixteen posts to the block, averages 8 cents a front foot.

More "White Way" Lighting at Kansas City, Mo.

For many years the streets of the business district of Kansas City, Mo., have been well lighted by tungsten and arc lamps, and now the popularity of this "white-way" lighting has spread outside the intensified business center to districts where the streets were formerly illuminated by gas. Among these new installations is one comprising several blocks of street lighting on East Fifteenth Street. These units are of a type similar to the four-lamp brackets carried by the trolley poles in the main part of the city. The lamps will be arranged on two circuits, the one over the sidewalk being operated all night and the other three until midnight.

The illustration herewith shows one of Kansas City's business thoroughfares lighted by the early incandescent bracket clusters. These units, each consisting of a cluster of lamps beneath a shade and a single frosted-globe lamp above, were among the first "white way" standards to be erected in the city about eight years ago. Practically all of the early installation are still intact.

ORNAMENTAL AND SIGN LIGHTING, KANSAS CITY, MO.

Illumination and Wiring

Economical Garage Sign

At a Newton (Mass.) garage the electric sign shown herewith has lately been installed, its chief features being its equal effectiveness both by day and by night and the low energy consumption required in consideration of its size. The sign is about 4 ft. 6 in. long and 30 in. high, and consists of two sections, one of which is transparent and the other reflecting in operation. The upper section contains on each side a panel of blue glass with white letters, behind which are mounted three 25-watt tungsten lamps in the center of the sign box. Depending from the center of the sign is a double-faced panel 12 in. high, carrying the word "Garage" in blue letters on a white background. The interior lamps suffice to illuminate both sides of this panel at once, and in a like manner both transparencies are lighted. The bottom of the lower panel is carried about 9 ft.

GARAGE SIGN AT NEWTON, MASS.

above the street and the sign box is 15 in. in width. Flexible conduit carries the wiring and the lamps are controlled by a single switch mounted just inside the garage. As the establishment is situated on a narrow side street, the economical sign illustrated has been a decided factor in bringing business to its door.

Tables of Wire Sizes and Starting Fuses for Induction Motors

The committee on the installation and operation of induction motors of the Western Association of Electrical Inspectors has prepared a number of tables giving the rating, full-load current, size of starting fuses and wire sizes with rubber and other insulation for induction motors of all frequencies and standard speeds and for standard voltages. The two principal rules which govern the size of wire to be used in connection with alternating-current motors are Rule 23 e and Rule 68 h. The accompanying tables, in the preparation of which these rules were taken into account, are based on the assumption that induction motors are started under 100 per cent load and that starting devices are used on motors larger than 5 hp. The question of drop is not taken into consideration at all.

It will be noted that provision is made for insulations other than rubber, since there seems to be no rule for the fusing of wire having slow-burning weatherproof or slow-burning insulation which makes any concession for this class of work. Owing to the fact that such wire is always exposed, is never installed in conduit and permits greater radiation, in the estimation of the committee it should be permissible to make the same reduction from Table B as is made between Tables A

TABLE I—SINGLE-PHASE, 110-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	13.3	35	8	10
2	24.8	65	6	8
3	36.	90	4	6
4	47.2	125	2	3
5	58.4	160	0	2
7½	85.2	225	00	0
10	110.	300	Circ. Mil 200,000	00
15	162.	400	300,000	0000

and B of the Code rules governing the allowable current-carrying capacities of wires. In determining the proper size of fuses to protect any apparatus, the overload time element should be considered in connection with the smallest current likely to prove dangerous to the apparatus. Where induction motors require at starting current several times more than a full-load value, fuses which will carry the starting current will not give much protection to the motor except against a short-circuit. The American Motor Manufacturers' Association has adopted a standard guarantee of 25 per cent overload for two hours, and the motor leads and auxiliary apparatus should be designed for this overload. Certain motors used for intermittent service such as valves, cranes, hoists, etc., require an overload capac-

TABLE II—SINGLE-PHASE, 220-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	6.65	25	12	14
2	12.4	30	10	12
3	18.	50	8	8
4	23.6	65	6	8
5	29.2	80	4	6
7½	42.6	120	2	3
10	55.	150	1	2
15	81.	220	00	0

ity of 200 per cent for short periods of time, and the overload protection should be rated accordingly. For ordinary service, motors should be protected by a fuse rated at 25 per cent more than the normal full-load current of the motor, which will insure the fuse opening of the circuit at approximately 50 per cent overload. For motors of intermittent rating, such as variable-speed motors, fuses rated at 60 per cent more than the normal thirty minutes current rating of the motor should be used, which will insure that the fuse will open the circuit on a continued overload of 200 per cent.

TABLE III—TWO-PHASE, 110-VOLT, FOUR-WIRE MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	6.04	20	14	14
2	11.2	35	10	12
3	14.7	50	8	8
4	21.6	70	6	8
5	28.6	90	4	6
7½	38.8	100	3	5
10	50.2	130	1	2
15	73.4	190	0	1
20	95.	250	000	0
25	118.	310	0000	00
			Circ. Mil	
30	138.	360	300,000	000
35	162.	430	350,000	0000
				Circ. Mil
40	182.	480	400,000	250,000
50	224.	590	500,000	350,000
60	268.	700	650,000	450,000
75	332.	890	900,000	600,000

TABLE IV—TWO-PHASE, 220-VOLT, FOUR-WIRE MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	3.02	10	14	14
2	5.6	20	14	14
3	7.35	25	12	14
4	10.8	30	10	12
5	14.3	40	8	10
7½	19.4	50	8	8
10	25.1	60	6	8
15	36.7	90	4	6
20	47.5	125	2	3
25	59.	150	1	2
30	69.	180	0	1
35	81.3	200	00	1
40	91.	240	000	0
			Circ. Mil	
50	112.	300	200,000	00
60	134.	350	250,000	000
				Circ. Mil
75	166.	440	350,000	250,000
100	218.	580	500,000	350,000
125	268.	700	650,000	450,000
150	320.	850	850,000	550,000
200	418.	1100	1,200,000	800,000

TABLE V—TWO-PHASE, 440-VOLT, FOUR-WIRE MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	1.51	5	14	14
2	2.8	10	14	14
3	4.6	15	14	14
4	5.4	20	12	14
5	7.15	25	12	14
7½	9.7	25	12	14
10	12.5	30	10	12
15	18.35	45	8	8
20	23.75	60	6	8
25	29.5	80	5	6
30	34.5	90	4	6
35	40.5	100	3	5
40	45.5	120	2	3
50	56.	135	1	2
60	67.	180	0	1
75	83.	200	00	0
			Circ. Mil	
100	109.	290	200,000	00
125	134.	370	300,000	000
150	160.	420	350,000	0000
				Circ. Mil
175	183.5	490	400,000	300,000
200	209.	550	450,000	350,000

TABLE VI—THREE-PHASE, 110-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	7.	25	12	14
2	13.	40	8	10
3	19.	60	6	8
4	25.	80	5	6
5	30.8	100	4	5
7½	44.8	120	2	3
10	58.	150	1	2
15	85.	225	00	0
			Circ. Mil	
20	110.	300	200,000	00
25	136.	360	250,000	000
30	160.	430	350,000	0000
				Circ. Mil
35	188.	500	400,000	300,000
40	210.	560	450,000	350,000
50	260.	680	600,000	400,000
60	310.	820	800,000	550,000
75	384.	1000	1,000,000	700,000

TABLE VII—THREE-PHASE, 220-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	3.5	10	14	14
2	6.5	20	12	14
3	9.5	30	10	12
4	12.5	40	8	10
5	15.4	50	8	10
7½	22.4	60	6	8
10	29.	75	4	8
15	42.5	100	3	6
20	55.	140	2	4
25	68.	175	0	2
30	80.	200	0	2
35	94.	250	00	1
40	105.	275	000	0
			Circ. Mil	
50	130.	350	250,000	000
				Circ. Mil
60	155.	400	300,000	200,000
75	192.	500	400,000	300,000
100	252.	650	600,000	400,000
150	368.	1000	1,000,000	700,000
200	484.	1200	1,400,000	900,000

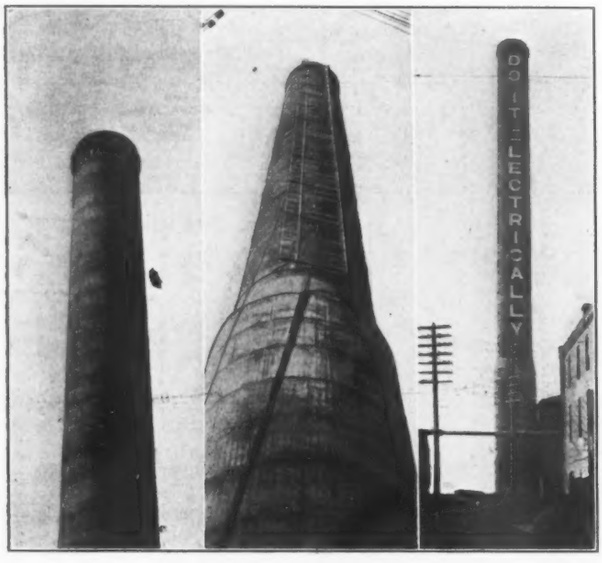
TABLE VIII—THREE-PHASE, 440-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	1.75	5	14	14
2	3.25	10	14	14
3	4.75	15	14	14
4	6.25	25	12	14
5	7.7	25	12	14
7½	11.2	30	10	12
10	14.5	40	8	10
15	21.2	50	8	8
20	27.5	65	6	8
25	34.	90	4	6
30	40.	100	3	5
35	47.	125	2	3
40	52.5	150	1	2
50	65.	175	0	1
60	77.5	200	0	1
75	86.	250	000	0
100	126.	325	0000	000
			Circ. Mil	Circ. Mil
150	184.	500	400,000	200,000
200	242.	640	550,000	400,000

Putting a 140-Ft. Sign Aloft with a Parachute

A parachute borne up through the stack interior by the flue gases and carrying with it a messenger cable made possible the erection of a 140-ft. electric sign, illustrated herewith, on the concrete chimney at the plant of the St. Joseph (Mo.) Railway, Light, Heat & Power Company. When the stack was originally finished no means were left for getting to the top, so that at first sight it seemed out of the question to place the sign without expensive scaffolding. The difficulty was finally solved, however, by the use of the parachute, which was sent up through the stack and allowed to fall back on the outside, bringing with it the line with which heavier cable was pulled into place. The steel framework was then placed in position and the sign erected as shown.

The display presents the slogan of the Society for Electrical Development, "Do it electrically," and is controlled by a flasher which successively turns on one letter after another. As the stack stands at the end of the town's principal business streets, the illuminated legend is particularly effective.



FIGS. 1, 2 AND 3—THE PARACHUTE, THE STEEL FRAME AND THE FINISHED SIGN

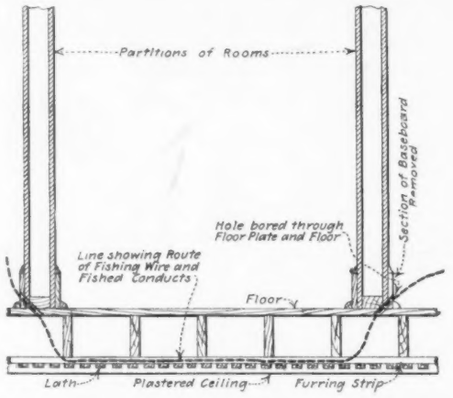
Fishing Conductors in Ceilings Laid on Furring Strips

BY GEORGE BLACKMAN

Where a ceiling is plastered on laths nailed to furring strips and it is desired to run conductors parallel to the direction of the furring strips (at right angles to the beams), the scheme outlined in the cut can often be adopted. With this method the removal of floor boards is unnecessary. The space provided by the furring strips between the tops of the laths and the bottom edges of the joists is sufficient to permit the conductors to be drawn through.

In installing conductors in such cases a section of baseboard is removed from a partition as indicated, and a 1-in. hole is bored for each conductor through the floor plate and floor into the space between the floor and ceiling. Where more than one conductor is to be drawn in, the holes should be spaced about 4 in. horizontally apart. A fish wire having a hook on its end is fed into each of the holes and worked along from opposite ends until the hooks engage each other, after which one of the fish wires can be used for pulling in a line to which is attached the conductor, either in circular loom or in flexible armored conduit.

If difficulty is experienced in pulling in the conductors, draw a length of steel-armored cable back and forth a number of times. This will produce a carving action and will cut away the plaster causing the interference.



METHOD OF FISHING CONDUCTORS IN A FURRED CEILING

Concrete Lamp Posts for De Kalb's "White Way"

De Kalb, a city of 10,000 inhabitants in the north central portion of Illinois, has recently placed in operation on its main thoroughfare a "white-way" lighting system which puts the city once again on an equal footing with its rival, Sycamore, not many miles to the north. Sixty-four lamps have been installed in the heart of De Kalb's business district, lighting six squares of the city's busiest street. The lamps are of the 6.6-amp luminous-arc type and are supported on concrete-granite ornamental posts. Each post is equipped with a Ludin cut-out and the lamps are wired on two separate circuits so that at 11 p. m. all but the lamps at the street corners can be extinguished. The latter are continued in operation all night. Both circuits are controlled from the station.

STREET LIGHTING, DE KALB, ILL.

The system was installed and is now being operated by the De Kalb & Sycamore Lighting Company, merchants in the business district co-operating with the city and paying for the installation. The posts were supplied by the Pettijohn Concrete Post Company, Terre Haute, Ind., and the lamps were furnished by the General Electric Company.

Recent Telephone Patent

A system of telephoning and signaling for lines where the telephone must not be directly inserted because of other current on the line has been patented recently. The transmitter is associated with the line through an induction coil with a low-wound coil in the line circuit and normally shunted by a knife switch. The receiver is similarly connected through another coil shunted by a condenser. A condenser is in series with the receiver and an adjustable retardation device is shunted across the receiver to adjust for different volumes. The receiver circuit is normally open; a connection can be made, through a switch provided, to a high-frequency diaphragm-type relay which in turn controls the signal-bell circuit. This patent is assigned to the Globe Telephone Company.

Letters to the Editors

Ozone Machines and Public Health

To the Editors of the Electrical World:

SIRS:—In the letter of Mr. H. A. Fee which appeared in your issue of last week the writer asks whether ozone in concentrations that may be borne readily by human beings will kill such bacteria as cause diseases of the respiratory tract. It has been shown that ozone is capable of destroying practically all species of disease germs when in the presence of moisture, with sufficient duration of contact and when the ozone is in adequate concentration.

Referring to only the most recent experiments with ozone in concentrations suitable for ventilation—viz., to those of Kukuck, Olsen, Jordan and Carlson and of the present writer—it may be said that such concentrations result in a marked and consistent lessening in the aerial bacterial content. In no case, however, were the bacteria of any specific species experimented on, or the precise amount of ozone recorded. The results show lessening in the numbers of bacteria ordinarily found in the air, but not complete sterilization.

Experiments with moist and with dried cultures show much less action on the latter than on the former, and experiments with various bacteria in water show a greater susceptibility to ozone on the parts of the disease germs than on those of non-pathogenic species.

It is probable therefore that the tiny globules of mucus—i. e., the "droplets" of Fluegge, Esmarch, and Winslow and Robinson—present the bacteria to the action of the ozone in air in their most vulnerable condition, and that when coughed or sneezed into the air they should be among those first destroyed.

It is questioned by such authorities as Chapin, Winslow and Robinson, Doty and others whether diseases are ever air-borne. Contact infection is now generally credited with causing most infectious disease transmission, and contact by "droplets" is undoubtedly an important factor in this. From the data available, therefore, it is reasonable to assume that ozone will prove of value in lessening the number of disease germs in the air.

Much of the discussion of ozone as an aid to ventilation has been inspired by misunderstanding of what it is intended to accomplish. Efforts at the destruction of plated or dried cultures or the combustion of solid carbon at ordinary temperatures are, of course, bizarre and useless. No method of room disinfection may be practised in the presence of the occupants, but this circumstance has never been used as an argument against room disinfection by any method other than ozone.

On the therapeutic applications of ozone much has been written, but it is not probable that it will find any considerable employment as a universal "home cure." Among expert medical practitioners it might prove of interest and value, but in the hands of the uninformed laity little need be expected along curative lines.

Ozone when intelligently applied is a valuable aid to ventilation. It imparts a freshness to the air which may not be obtained by other means, and it destroys odors and organic emanations arising from the presence of people and animal matter even when the latter is in an advanced condition of decay. The most persistent and painstaking efforts have failed to disclose the least harmfulness of ozone properly used, and on the other hand numberless practical demonstrations of its beneficial effects exist in the installations which have been in operation for several years on both sides of the Atlantic.

East Orange, N. J. MILTON W. FRANKLIN.

The Edison Battery

To the Editors of the Electrical World:

SIRS:—Referring to the protest of Mr. R. A. Bachman on page 158 of the *Electrical World* of Jan. 17 concerning the concluding paragraph of my review of the storage-battery situation in your New Year's number, I feel that the sole merit of Mr. Bachman's comment lies in the inalienable right of any American citizen to protest against anything regardless of facts or logic. In my review no comparison was drawn between the nickel-iron and the lead-lead cell, and none was implied. If that had been the purpose of the article, there would have been occasion for the protest.

It is a business axiom that if two devices serve practically the same purpose and one costs three times as much as the other, the higher cost is a handicap on the more costly article regardless of the comparative merits of the two. Protest against the statement that this obvious fact is true, scarcely calls for comment.

New York, N. Y. LAMAR LYNDON.

Combined Synchronous and Induction-Motor Loads

To the Editors of the Electrical World:

SIRS:—In his interesting article under the above title in your issue of Nov. 22, 1913, Mr. H. L. Wallau gives advice on methods of counteracting poor power-factors, and he recommends the use of over-excited synchronous motors and converters. It is regrettable, however, that such apparatus is not always applicable. In many plants employing individual drive the primary cause of low power-factors may be traced to the presence of a large number of induction motors, each of small individual rating. For example, in a certain factory, distinguished as an example of individual drive, each of its three hundred looms was driven by a 0.45-hp motor, with the result that at the busbars the power-factor measured was only 62 per cent. For a group-drive arrangement corresponding to this condition the power-factor would be much improved and would never be below 80 per cent. This interesting fact shows one of the most important disadvantages of individual drive as compared with group operation, and should never be neglected in the layout of motor installations.

Zwickau, Germany. G. W. MEYER.

Field of the Operating Engineer

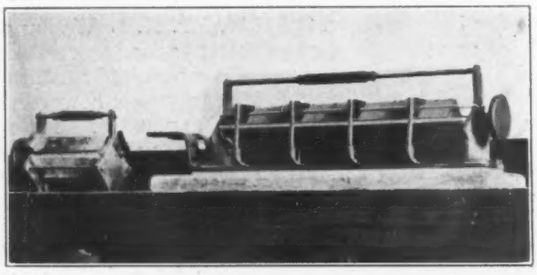
A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Overloading Grid Resistors

In determining the starting characteristics of large electrical machines under test the grid resistors in the starting circuit are often called upon to carry exception-all heavy overloads for short periods. On the test floor of a large electrical manufacturer, to avoid the use of an extra bank of resistors for this purpose, one man is provided with an air hose and nozzle from which he plays a constant stream of air on the grids. The air currents set up carry away the heat much more quickly than would be accomplished by ordinary convection alone, so that the resistors may be worked at current values which would otherwise raise them to a red heat.

Portable Resistor Outfits for Meter Testing

Every possible reduction in weights is of course desirable in portable resistors used as loads for meters under test on consumers' premises. A compact form of resistor for such service has recently been designed by Mr. Harry Amundsen of the Boston Edison company's meter department and is illustrated herewith. The larger resistor shown has a current-carrying capacity of from 25 amp to 600 amp and is 21 in. long over all, 5 in. wide and 6.375 in. high. The smaller outfit, seen at the left, measures 7 in. by 3.5 in. by 5 in. and has a carrying capacity of from 15 amp to 300 amp. Both are of the carbon-plate type and are adjusted by mechanical pressure applied through a handle and set-screw. In the larger resistor there are eight sections of carbon blocks each 1.5 in. square and 0.125 in. thick, while the smaller apparatus is made up of the same-sized blocks but contains only three sections. Thirteen blocks are used per section. The 600-amp resistor is provided with two copper buses 0.25 in. thick and 1 in. wide, set 2.125 in. apart on centers. The carbon blocks are carried in a V-shaped trough of 0.1875-in. asbestos board held in position by two 0.3125-in. brass rods. At the top of the frame is a 0.125-in. brass rod with a rubber

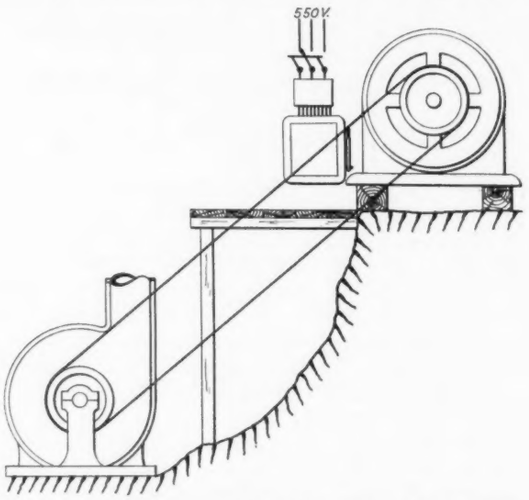


RISISTOR UNITS FOR METER TESTING

handle in the center. The extreme travel of the set-screw in the larger outfit is only 0.1875 in. between 25 amp and 600 amp. Two of these units connected in multiple will safely give a load of 1400 amp. The smaller resistor unit is designed to be clamped directly on the battery and in series with it. The larger resistor weighs 131 lb. 10 oz. and the smaller one 3 lb.

Improper Location of Motor Starter Near Belt

The conditions shown in the accompanying sketch contributed to what might have been a serious accident and should serve as a warning against the careless placing of motor starters near moving belts. A second-class electrician had been employed on the night shift of



MOTOR AND TURBINE PUMP WITH STARTER IMPROPERLY PLACED

a large contracting firm to look after six 250-hp induction motors belted to drive centrifugal pumps used for drainage purposes. The whole installation was a temporary one. The motor shown was mounted about 15 ft. higher than its pump, the belt ran down at a slope of 45 deg., and the compensator and main switch were mounted on the wall beside the motor. One night the attendant got an order from the master mechanic to shut down this pump. He proceeded as usual and pulled the compensator handle to the neutral position, but the motor continued running and refused to stop. After looking about to see if something was wrong, he finally pulled out the main switch and the motor stopped. Then the attendant went elsewhere to look after some other matters, but shortly remembered the motor trouble, and again set out to investigate its cause. He moved the compensator handle first to the starting and then to running position, but because of a lack of mechanical skill he failed to notice that some of the contact fingers were welded to the contacts on the revolving drums. In thinking to move the compensator handle to the neutral position, he had moved only the drum-shaft handle, while the compensator itself still remained on the running side. He then threw in the main switch, an operation which was followed by a blinding flash, and at the same time he was thrown down from the wood platform and fell into the 48-in. belt. The motor was running clockwise and, fortunately, the belt speed was not so high as to bring him more than half way up to the motor pulley, where he would certainly have been killed. As it happened, he was simply thrown back and forth on the belt a couple of times, finally being rolled

out on one side, and thus luckily escaping without serious injuries.

To repeat the lesson taught by this accident, motor switches and starters should never be installed in locations where a sudden shock or flash may surprise the attendant and cause him to fall into moving machinery or belts.

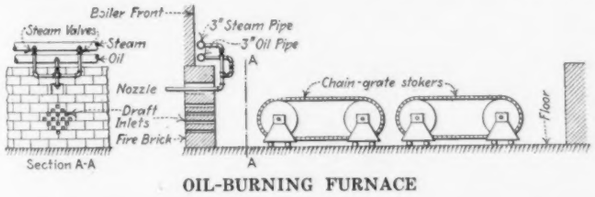
Improving Operating Performance of Mercury Rectifier Tubes

Improved operating records for mercury-arc rectifier tubes have recently been secured in the municipal power plant at Springfield, Ill., which supplies the local street and park lighting. These tubes, operating on fifty-lamp rectifier sets supplying 4-amp lamps, formerly gave considerable trouble after having been in service for a few days. It was not an infrequent occurrence for a tube to drop its lead several times during an evening's operation.

A tight double-walled box containing 0.5-in. steam coils was then constructed under the direction of Mr. James E. Dolbey, chief engineer at the station, and the tubes were taken from the rectifier outfits each day and baked for two or three hours in the dry heat of the steam oven. The tubes in operation in January showed records of 4215 hours and 2740 hours respectively and were still giving service the quality of which was much more satisfactory than that of the comparatively new tubes which were operated without the baking process.

Oil-Fired Furnaces for Peak-Load Operation

In the Metropolitan plant of the Kansas City (Mo.) Railway & Light Company ten out of the entire bank of forty boilers, aggregating 24,000 hp, are now being operated with oil burners, and, according to Mr. John Fritts, general superintendent for the company, the normal rating of the steam-generating equipment of the station has been increased about 20 per cent by the



OIL-BURNING FURNACE

change. These ten boilers were formerly equipped with chain-grate stokers, but the latter have been moved back to the center of the firing aisle and the openings walled up with firebrick. The accompanying sketch shows the present position of the idle coal-stoking apparatus and the arrangement of the piping for delivering the fuel oil and the steam used to atomize it.

One of the main reasons for the installation of this oil-burning equipment was the need for steaming apparatus which could be brought up to operating pressure quickly in times of peak load, without the necessity of maintaining several banked fires. With the present arrangement the oil-burning boilers may be "steamed up" and made ready for action more quickly than those coal fires of the plant which formerly were banked. For this reason the number of banked fires is kept at a minimum, the majority of coal-burning furnaces being operated throughout the twenty-four hours, while the oil-burning units are kept as reserves to carry the peaks. In this way the greatest economy in fuel is obtained, since only the boilers which are actually furnishing steam to the mains are supplied with fuel.

Before the stack equipment of the station was doubled the oil-fuel boilers were of great value in plant operation, as they did not require a high degree of draft for their efficient operation. Since, however, two new stacks, measuring 15 ft. in inside diameter and 265 ft. in height, have been erected this consideration has become of minor importance.

Two types of burners, the Roup and the Billows, are being employed. Oil is fed at 40-lb. pressure from six tanks in the basement of the station, being atomized by live steam from the mains running along the front of the boilers. The pressure at the nozzles, after the oil and steam have been mixed, is approximately 80 lb. per sq. in. For storing the fuel oil seven tank cars are kept on the station spur track at all times, and as the fuel is needed it is fed to the six storage tanks in the basement. These tanks have a capacity of 100,000 gal. About 180 gal. per hour is consumed by each 600-hp Babcock & Wilcox boiler.

Ordinarily the time required for changing one of these large units from a coal burner to an oil burner is about forty-eight hours. For an emergency service, however, the chain-grate stokers are left in place so that a change back to coal firing can be made in a night.

A drawback in the use of oil as fuel lies in the fact that it has been impossible for the central-station companies to secure contracts for oil at stated prices. Hence when a station has fitted its steaming equipment for operating with oil it has no assurance that the price of the liquid fuel will remain within a figure that will make its use an actual economy.

Electrical Uses of Tungsten

Can you advise me of other electrical uses for tungsten besides its application to the filaments of incandescent lamps? I understand that it has been employed to form the sparking contacts of gasoline engines. F. M. H.

Although a chemistry textbook issued only a few years ago refers to compounds containing tungsten as being "numerous, complex and not of any commercial importance," a number of applications have been found for this metal since it became generally used in the filaments of incandescent lamps. Tungsten has been utilized with advantage in the anodes of X-ray tubes, its high melting point enabling it to withstand the cathode bombardment and to undergo temperatures which make present high-speed skiagraphy possible. It is also used in electric furnaces, both in the form of strips for winding coils and in tubular form. At high temperatures it is recommended that the metal be kept in a vacuum or surrounded by hydrogen, nitrogen or some other gas which does not act upon it. Tungsten has been widely used for sparking points and other electrical contacts. Some automobile manufacturers have even adopted tungsten throughout for all electrical contacts. Wrought tungsten has been hardened to such a point that it scratches glass yet remains ductile. Tungsten gauze is used successfully for separating solids from acid liquids, and tungsten metal should be in demand for acid baths in manufacturing processes. An important property of the metal is its insolubility in most common acids, including hydrochloric and sulphuric acid, although hydrofluoric acid and nitric acids will attack it. The melting point of tungsten is 3100 deg. C. and its tensile strength is approximately 500,000 lb. per sq. in. It is a very heavy metal, having a specific gravity of 20. The principal ore of tungsten is wolframite, a combination of tungsten and iron salt. This ore, when heated with sodium carbonate, produces tungstic acid, which is later reduced to tungstic oxide. Pure metallic tungsten is gray in color.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Three-Phase Commutator Motor.—H. K. SCHRAGE.—Fig. 1 shows a three-phase commutator motor built according to the designs of J. L. La Cour by a Swedish company. *P* is the primary winding in the stator, *R* is the regulating winding, also placed in the stator, and *S* is the rotor winding which is constructed as a direct-

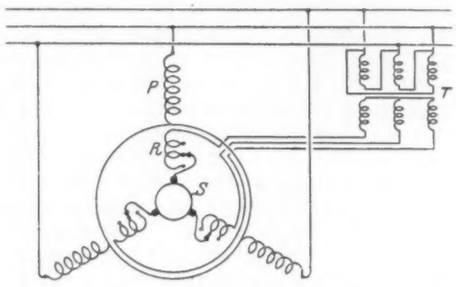


FIG. 1—DIAGRAM OF CONNECTIONS, THREE-PHASE COMMUTATOR MOTOR

current winding with a commutator. Speed regulation is obtained by impressing a variable voltage upon the rotor. For this purpose the regulation winding is provided with several contact points. *T* is a small transformer which supplies to the rotor the voltage required for its compensation. The speed of these three-phase commutator motors can be regulated within much wider limits than the single-phase commutator motors of the same design. Nevertheless, they have not been very successful commercially on account of their expense, which is chiefly due to the great complication and cost of the controller. The present author has largely reduced this expense by employing speed regulation by means of brush displacement so that no con-

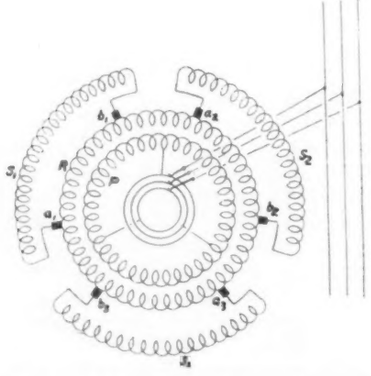


FIG. 2—THREE-PHASE COMMUTATOR MOTOR WITH SELF-CONTAINED REGULATING WINDING

troller is used. The new motor is cheaper and simpler and the regulation is not in steps but continuous. The connections are shown in Fig. 2. Here *P* is the primary winding, *R* the regulating winding and *S* the secondary winding, but in this case *P* and *R* are placed in the rotor and *S* in the stator. The primary winding is supplied with current through slip-rings. The regulating winding is constructed as a closed direct-current winding with a commutator, and the secondary winding consists of three phases separated from each other, connections being made between the different brushes as shown in the illustration. The brushes a_1, a_2 and a_3 are mounted on one brush bridge and the brushes b_1, b_2 and b_3 on a second brush bridge. The effect which the position of the brushes has on power-factor and overload capacity is discussed. Concerning its commutation the motor is compared with the well-known three-phase shunt motor with controller.—*Elek. Zeit.*, Jan. 22, 1914.

"Condenser Machine."—H. WOMMELSDORF.—An illustrated article on the author's "condenser machine," describing the gradual evolution of its design, with notes on its operation and uses. It is especially adapted for electro-therapeutic and Roentgen-ray work. With this machine it is possible to produce high-tension direct current, the output being very much greater than with

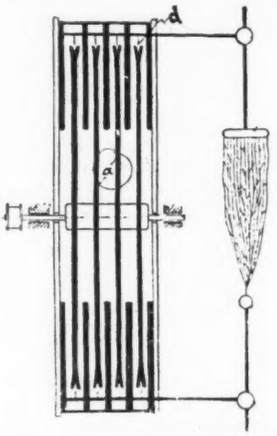


FIG. 3—"CONDENSER MACHINE"

ordinary influence machines. The construction of such a condenser machine is shown in Fig. 3. Sets of stationary disks and rotating disks are arranged in the form used in condensers so that every rotating disk *a* receives an induced charge on both sides. The charge is taken off the rotating disks *a* by means of steel wires *d* sliding and pressing against the rim of the rotating disks. A second important feature is the use of bakelite. It is stated that the machine could not have been perfected until a technically useful insulating material was found. This was found in bakelite, with which the hard-rubber disks were coated; "thereby the condenser machine was rendered durable and technically useful."—*Elek. Zeit.*, Jan. 15, 1914.

Mercury-Vapor Rectifiers for Speed Regulation of Motors.—F. W. MEYER.—The conclusion of his illustrated mathematical article on the subject.—*Elek. Zeit.*, Jan. 8, 1914.

Polyphase Commutator Motors.—H. MEYER-DELIUS.—An article illustrated by diagrams in which the theory of the direct-current motor is first outlined, and

it is shown that the same principles apply to the polyphase motor, the only difference being that by reason of the alternating nature of the current a reactance drop has to be added to the ohmic polyphase drop. Making use of elementary geometrical relations of vectors, the author develops a diagram for the polyphase series motor, by means of which the current, power-factor, speed, torque and efficiency can be determined for different values of load. It is shown how this diagram can be drawn after the reactance and the resistance of the motor have been determined either by test or calculation. The diagram is finally applied to the brush-shifting series motor invented by Goerges, the commercial application of which has only recently become possible as a result of a better understanding of alternating-current commutation.—*Gen. Elec. Rev.*, February, 1914.

Synchronous Converters.—J. L. BURNHAM.—When the first sixty-cycle synchronous converters were brought out they were regarded as rather sensitive pieces of apparatus. The improvements which have been made in recent designs have, however, placed them on a par with their twenty-five-cycle prototypes. The author describes salient features of the changes which have been made, why they were made and their effects on the characteristics of the machines.—*Gen. Elec. Rev.*, February, 1914.

Armature Reaction.—R. H. TABER.—An article illustrated by diagrams of armature reaction in direct-current machines. The author discusses the principles of action, the distortion of the main field, the effects of distortion on commutation, armature magnetization, effects on brush displacement, effects of armature reaction and means for reducing reaction effects.—*Elec. Journal*, January, 1914.

Lamps and Lighting

Stage Lighting.—C. MICHALKE AND A. GRILLMAYR.—An illustrated article on arc-lamp systems for producing different sky effects on the stage, as, for example, a blue sky, a clouded sky or a night sky with stars. On account of their richness in blue rays arc lamps are especially adapted for this purpose.—*Mitt. Siemens & Halske*, December, 1913.

Instantaneous Candle-Power of Alternating-Current Lamps.—J. SAHULKA.—The author describes a new

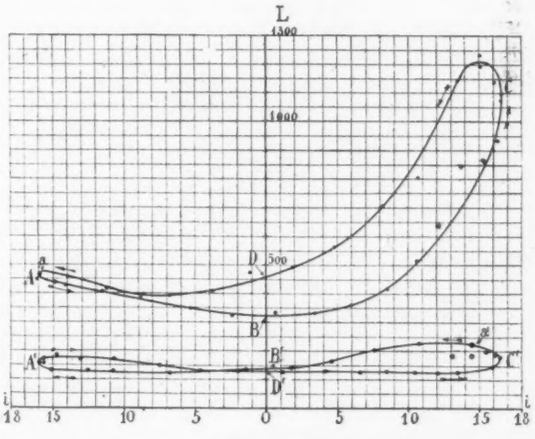


FIG. 4—CHANGE OF CANDLE-POWER OF ALTERNATING-CURRENT ARC LAMP DURING ONE PERIOD

method for measuring the instantaneous candle-power of alternating-current lamps and the fluctuation of this candle-power during one cycle of the wave. Fig. 4 shows the results for an alternating-current arc lamp with the carbons perpendicular, one above the other, the upper carbon being positive. There are two curves shown in this diagram, of which the upper curve shows the fluctuations of the candle-power measured at an angle of 45 deg. against the vertically downward candle-power. The lower curve gives the fluctuation of candle-power in a horizontal direction during one cycle.

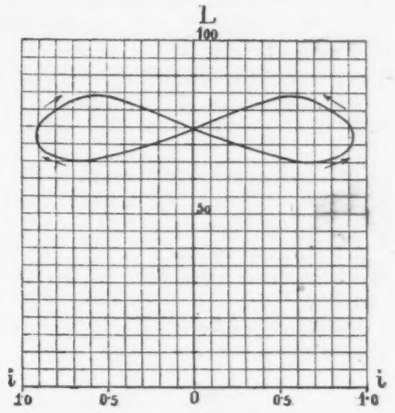


FIG. 5—CHANGE OF CANDLE-POWER OF TUNGSTEN LAMP DURING ONE PERIOD

The abscissas represent current in amperes; the ordinates the instantaneous candle-power. Fig. 5 shows an analogous candle-power curve for a tungsten incandescent lamp.—*Elek. u. Masch.* (Vienna), Jan. 4, 1914.

Ductile Tungsten for Drawing Filaments.—A note on a recent British patent (No. 26,800, 1912) of C. Trenzon. To make tungsten or other non-ductile or slightly ductile metals ductile by mechanical working, hydraulic pressure is applied to the amorphous metal (which must contain no crystalline particles or oxide) when for the first time heated to a temperature at which it tends to become crystalline. Thus, increase of density is brought about at the moment when, as the result of heating, the change from the amorphous to the crystalline would tend to occur.—London *Elec. Eng'ing*, Jan. 22, 1914.

Lamp Substitution Resistances.—A note on two recent British patents (Nos. 9530, 1913, and 10,018, 1913) of W. Heins. A small disk of carborundum with convex sides is placed in parallel with the lamp or lamps and is found in case of failure of the lamps to assume the same resistance as the lamp, whereas as soon as the lamp circuit is completed through a new lamp the carborundum reverts to its normal high resistance. A substitute lamp may be brought into circuit by arranging that the heating of the carborundum shall operate a contact in the emergency-lamp circuit.—London *Elec. Eng'ing*, Jan. 22, 1914.

Double-Electrode Arc Lamps.—J. SCHMIDT.—A full description of the "Excello" double-carbon arc lamp. When one pair of carbons has burned out the other pair is automatically connected to the circuit. The total life obtained is about thirty-two and thirty-six hours respectively for direct current and alternating current. The specific consumption is 0.2 watt to 0.17 watt per hefner-candle.—*Zeit. f. Beleucht.*, Jan. 10, 1914.

Generation, Transmission and Distribution

Electricity Supply of Large Cities.—S. KLINGENBERG.—The author's paper on the subject, which was recently presented in London and noted in the Digest from abstracts in the British papers, is now printed in full in German with numerous diagrams. The first instalment appears in *Elek. Zeit.*, Jan. 22, 1914.

Electricity Supply in Great Britain.—Some further statistical tables. The first gives a list of the sixty towns which take their electricity supply "in bulk."

The second table gives a list of 141 central stations supplying energy both for lighting and tramways. For each station a number of tables are given on management, equipment, etc.—Supplement to London *Electrician*, Jan. 23, 1914.

Power from Mercury Vapor.—W. L. R. EMMETT.—In a continuation of his former article the author describes some of the first experiments he made on the application of mercury vapor as a means of generating power. He especially describes the development of design for a mercury boiler to produce the vapor with practical methods of firing.—*Gen. Elec. Rev.*, February, 1914.

Motors in the Leather Industry.—A. E. RICKARDS.—A statistical article outlining the salient features of the leather industry along with its motor requirements and methods of application.—*Elec. Journal*, January, 1914.

Motors in the Cement Industry.—P. N. HARRISON.—An article giving statistical data on motors required in cement plants, their energy consumption, etc.—*Elec. Journal*, January, 1914.

Traction

Electrification of Swiss Railways.—J. REYVAL.—A continuation of his account of the report of a special committee which investigated the problem of electrifying the railways of Switzerland. In the present instalment different electrical systems are compared. A conclusion is reached in favor of the fifteen-cycle, single-phase system operated at a pressure of 15,000 volts to 10,000 volts, and it is pointed out that this view is identical with the conclusions of the commissions which have studied railway electrification in Prussia, Bavaria, Austria and Sweden.—*La Lumière Elec.*, Jan. 17, 1914.

Installations, Systems and Appliances

Electric Cooking.—An illustrated article on the cost of electric cooking at Romano's restaurant in the Strand in London. From the figures given it appears that to grill by gas costs $365 per annum, with gas at 62 cents per 1000 cu. ft., while to grill by electricity costs something less than nothing, for, in fact, there is a profit of $10.87 on the sale of fat, with current at 2 cents per kw-hr. At Romano's the fat drops, not into the fire, as is the case with a coke grill, but into a special drip tin which is protected from the heat. Here it coagulates and is collected, being afterward sold at a market price of 16 cents per lb. Thus not only is much unpleasant smell and noise, inseparable from other methods, avoided—one of the features of this grill being the quietness of its operation—but the operating costs are actually less than nothing, even after standing charges and meter rent have been allowed for. This particular equipment is in use in the aggregate for nearly twelve hours a day.—London *Electrician*, Jan. 23, 1914.

Wires, Wiring and Conduits

Overhead-Line Construction.—A. P. TROTTER.—An abstract of an illustrated paper read before the (British) Institution of Post Office Electrical Engineers on overhead-line construction for medium and low voltages. Several special designs of poles and insulators are illustrated.—London *Electrician*, Jan. 23, 1914.

Electrophysics and Magnetism

Wheatstone Bridge.—R. NEUMANN.—To find the values of the currents and voltages in a Wheatstone bridge by arithmetic a number of calculations are necessary. The author describes a graphical method which solves the problem in a very convenient way.—*Elek. u. Masch.* (Vienna), Jan. 18, 1914.

Electrochemistry and Batteries

Oscillation Transformer for Insulator Tests.—S. THOMSON.—An article giving a description of the various parts of an oscillation transformer, an explanation of the electrical factors entering into its design, information relating to the materials to be used and data for its calculation. Oscillation transformers have recently come into use for testing insulators, as they offer a cheap means of obtaining a very high voltage. Experience shows that the high-frequency discharge can find defects in insulators which have passed the standard sixty-cycle tests.—*Gen. Elec. Rev.*, February, 1914.

Units, Measurements and Instruments

Absolute Measurement of Resistance.—F. E. SMITH.—A note on a paper read before the Royal Society in London on the absolute measurement of resistance by a method based on that of Lorenz. The instrument employed differs, however, from all other forms of apparatus based on the Lorenz method inasmuch as two disks are employed instead of one. The disturbing effect of the earth's magnetic field is thus practically eliminated. The magnetizing coils are four in number; they are wound in single layers on marble cylinders, and the disposition of the coils with respect to the disks is such that the resulting magnetic fields through the disks are opposed in direction and the intensity of the field at points in the neighborhood of the edge of a disk is of zero value, or nearly so. Each of the two disks supports ten insulated bronze segments placed at equal distances round its circumference, and the ten segments on one disk are connected to those on the other disk by ten conducting wires passing through the center of the shaft. When the wires rotate a difference of potential is produced between their ends. These differences of potential may be placed in parallel or in series and balanced against that on a standard resistance R through which the same current flows as through the coils. The resistance R can thus be found in terms of the mutual inductance of the coils and brush-contact circles and the rate of rotation of the conductors. The brushes consist of thin phosphor bronze wires stretched by spiral springs and resemble violin bows. Petrol is employed as a lubricant for the brushes. The speed is maintained constant by an electrical method. The result of the experiments shows that a resistance of 1 international ohm is equal to 1.00052 ± 0.00004 ohms (10^9 cm./sec.)—London *Electrician*, Jan. 9, 1914.

Meter.—An official communication from the Reichsanstalt by which a mercury-motor meter for direct current by H. Aron is admitted for calibration. Its construction and operation are described and illustrated.—*Elek. Zeit.*, Jan. 15, 1914.

Telegraphy, Telephony and Signals

Telegraphy in Germany.—O. ARENET.—An illustrated article on the development of telegraph operation in the large underground cable systems of Germany. The first telegraph cables were laid in Germany in 1876. The author describes in detail how, especially through the work of the telegraph experiment station of the Post Office Department, various improvements have been made so that reliability of operation by the Hughes system has been made possible on lines up to 400 km (240 miles) and by the Morse system up to 500 km (300 miles). The present arrangement permits utilizing each cable conductor to an extent ten times that which was possible in 1888.—*Elek. Zeit.*, Jan. 22, 1914.

Tone-Wheel for Wireless Telegraphy.—R. GOLDSCHMIDT.—A mechanical detector for electrical waves is described, by which undamped continuous waves can

be received as a musical note and the pitch of the note adjusted at will at the receiving station. The author makes use of Fessenden's idea to apply a high-frequency current generated at the receiving station and uses a modification of Le Blanc's "commutatrice" for the reduction of the high-frequency currents. In order to construct the latter device in as simple a way as possible, the commutator is replaced by a toothed-wheel disk. This apparatus does not commutate but simply interrupts the alternating-current once for every wave. It is not at all difficult to obtain the necessary number of interruptions. If, for instance, a current of 40,000 periods per second is to be commutated and the tooth pitch at the circumference of the toothed wheel is 1 mm, a synchronous rotation is obtained with a circumferential velocity of 40 m per second, which is quite within the limits of possibility; but practically it is not possible to maintain the synchronous rotation of the tone wheel. Therefore the number of revolutions is chosen to be non-synchronous. If the alternating current has a frequency of 40,000 cycles per second, the number of interruptions is made, say, 39,000 or 41,000. The commutated current then is a "notched" alternating current with a frequency of 40,000 — 39,000 = 1000 cycles. It is not necessary, however, to choose the speed of the wheel so that it is near synchronism; any uneven fraction of the synchronous number of revolutions may be employed. The wheel is driven by a small motor, with which is coupled an automatic regulator (with a centrifugal contact-making arrangement) and an eddy-current brake. Damped waves, such as those emitted from spark stations, are not heard as a note but only as a noise. Stations with only small differences in wave-length are heard with very different notes. If the tone wheel, for instance, is giving 39,000 interruptions and the station to be received is sending with 40,000 periods, this station will be received with a note of 1000 periods. Another station using, for instance, a 2.5 per cent shorter wave (that is, 41,000 cycles) gives a note of 41,000 — 39,000 = 2000 cycles. It is, therefore, very easy to distinguish one station from another. The tone is clearly distinguished from atmospheric disturbances. As always a certain note is best suited for a certain telephone, and as it is possible at the receiving station to adjust the pitch of the received note, the pitch may be regulated according to the telephone used so as to obtain the maximum effect. This advantage is, perhaps, the most important. Intensifications up to about ten times may in this way be easily obtained—London *Electrician*, Jan. 16, 1914, and *Elek. Zeit.*, Jan. 22, 1914.

Electrolytic Detector.—PAUL JEGOU.—An illustrated article describing the principles of the electrolytic detector, the practical forms in which it has been carried out and the various methods employed for connecting it with the antenna. The author defines what he calls the "critical tension" of an electrolytic detector and gives values for certain electrolytes and electrodes. He finally distinguishes between two kinds of critical tensions, namely, the anodic tension and the cathodic tension.—*La Lumière Elec.*, Jan. 17, 1914.

Miscellaneous

Arc Welding.—E. S. ZUCK.—There are two methods of electric arc welding, namely, the carbon-electrode arc process of Benardos and the metallic-electrode process of Slavianoff. Their features and differences are discussed. The author describes the application of the electric arc method for the welding of flues in locomotive boilers in steam railway shops, for building up mud rings, for repairing broken motor frames, etc. Some notes are added on overhead welding.—*Elec. Journal*, January, 1914.

Book Reviews

DIE THEORIE MODERNER HOCHSPANNUNGS-ANLAGEN. By Dr. Ing. A. Buch. Munich: R. Oldenbourg. 360 pages, 118 illus. Price, 14 marks.

A carefully prepared textbook on the theory of high-voltage conductors and systems from the electrical-engineering standpoint. A number of numerical examples are given and worked out in the text. The eight chapters of the book relate to the following subjects: Dielectric strength; design of high-tension conductors; corona; high-tension insulators; high-tension cables; over-voltages; lightning protectors; protectors against abnormal current strengths. The treatment is mathematical, but is also of a distinctly engineering type. A number of curves and tables are distributed throughout the book, which will commend itself to advanced students of high-tension cables and systems, if acquainted with the German language.

LES SURTENSIONS DANS LES DISTRIBUTIONS D'ENERGIE ELECTRIQUE ET LES MOYENS D'EN PRÉVENIR LES INCONVENIENTS. By I. Van Dam. Amsterdam, Holland: Van Mantgem & de Does. 272 pages, 109 illus., paper covers. Price, $2.40.

An engineering textbook on the subject of overvoltages in power-transmission lines and of methods for preventing them. It deals largely with American practice and experience, although the book is directed mainly toward European electrical engineering. The treatment is clear and well selected. Examples are taken from a number of actual installations. The book will be of interest to all students of high-tension electrical engineering. The thirteen chapters into which the work is divided relate to the following topics: Rupturing voltage; corona; high-tension insulators; self-induction and capacity of lines; harmonics in alternating-current waves; resonance; overvoltages at the distant ends of lines; overvoltages due to changes in load; overvoltages due to atmospheric disturbances; lightning protectors; grounding; crosses between high-tension and low-tension systems; factor of safety in high-tension distributions.

DESCRIZIONE DI UNA MACCHINETTA ELETTRO-MAGNETICA. Dr. Antonio Pacinotti. Bergamo, Italy: Instituto Italiano d'Arti Grafiche. 95 pages, frontispiece of Pacinotti.

A very interesting little book from the historical point of view. It is published by the Associazione Elettrotecnica Italiana, which corresponds, in Italy, to our American Institute of Electrical Engineers. It reproduces the text of Dr. Antonio Pacinotti's "Description of a Small Electromagnetic Machine," which was written in June, 1864, and was published May, 1865, in *Il Nuovo Cimento*. This article clearly describes a bipolar dynamo-electric machine with a gamma-ring toothed armature. The machine was operated both as a generator and as a motor. As a motor it had a torque of 215 meter-grams when operated by a battery of four small Bunsen cells. This article manifestly established the reversibility of the dynamo machine in 1865, but at the time it attracted hardly any attention. The discovery had to be made all over again at a later date, in order to stir the electrical engineering intelligence. The article is translated into French, English, German and Latin by well-known writers—a distinct enhancement of its historical literary value. As the frontispiece appears an excellent portrait of Dr. Pacinotti, who received an ovation at the International Electrical Congress of Turin in 1911, one year before his death.

Sale of Electrical Appliances on a Proper Basis

Shortcomings of supply dealers, contractors, jobbers and central stations in marketing goods and in their relations with one another

Retail Electrical Merchandising

Retail electrical merchandising was poorly conducted in the early days of the electrical business because its importance was not realized, it being considered as merely incidental to the sale of electricity. No attempt was made to educate employees of light and power plants in the fine art of retail salesmanship. An evil of the business has been the tendency and actual practice by many operating companies to sacrifice the legitimate profit on a sale as an inducement to customers to use energy-consuming devices. Houses have been wired at cost and in some cases without charge. Motors, fans, fixtures, heating and cooking devices, etc., have been sold at cost or given away. The effect of such practices is to create in the mind of the public the impression that electricity is hard to sell upon its merits, or at least to impress upon people that in dealing with an electric-light plant something can be had for nothing; and if one can get something for nothing he is inclined to consider it of little real value.

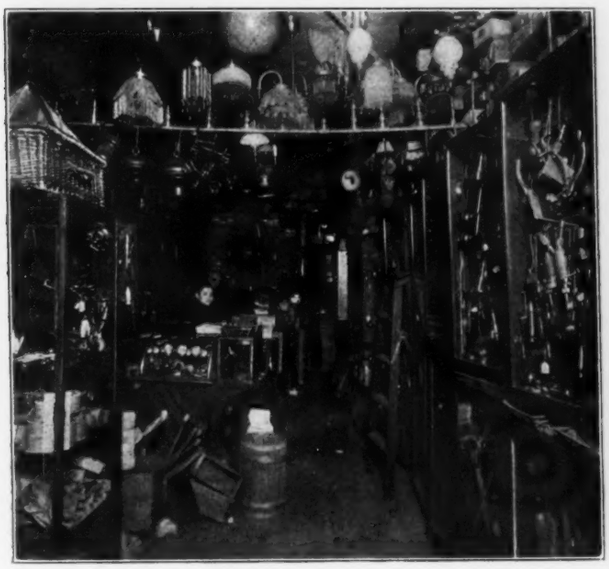
It is fair to say that managers of electric-light plants, as a rule, have a good knowledge of the electrical business from a practical standpoint. They know how to construct power plants and pole lines and provide service to consumers and are well qualified to pass upon the quality of electrical appliances of all kinds. They know how to make rates and furnish electricity to their customers. All of this is part of their vocation, and is so different from retail electrical merchandising that electric-light company managers have not given the latter consideration from a good business basis.

The Primitive Storeroom

In the earlier days of the lighting business it was the usual practice of operating companies to establish a storeroom for electrical goods at the power plant, oftentimes in one corner of the engine room or in a shed adjoining the coal bin. Contracts were made for furnishing service, and these usually included the wiring of the premises. A wagon was loaded with a coil of wire, some lamp cord, a few sockets and a couple of ladders, and a trip was made from the storeroom at the plant. The delivery of the material accomplished, the wiremen installed the job. If, however, the job happened to be in a residence of a citizen who wanted fixtures or other elaborations, the foreman or possibly the superintendent would tuck a catalog under his arm

FIG. 1—INTERIOR OF ELECTRIC SHOP OF COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

and visit the lady of the house, granting her the privilege of selecting what she wanted from the catalog, after which an order was placed with the jobber or manufacturer. Eventually the goods were received at the storeroom, unpacked and installed, after which the lady of the house had an opportunity to decide whether lamps, ornamental and scientifically designed shades, dining-room domes, fans, flatirons, toasters, percolators, curling irons, vacuum cleaners, vibrators, etc. This seemed to call for some plan of exhibiting and advertising. So the light and power company either established a store or induced some of its good wiremen to



FIGS. 2 AND 3—CONGESTED AND UNINVITING APPEARANCE OF AVERAGE ELECTRIC SUPPLY STORES

or not she liked the goods. If so, well and good; if not, she was reminded that they were just what she selected and ordered.

After a while, electrical novelties and conveniences began to appear, such as fancy portables and reading establish a retail store and contracting shop. In either event the business was usually in charge of a man very competent to do electrical work but who had not the slightest conception of what went to make an attractive retail establishment. Usually a start was made

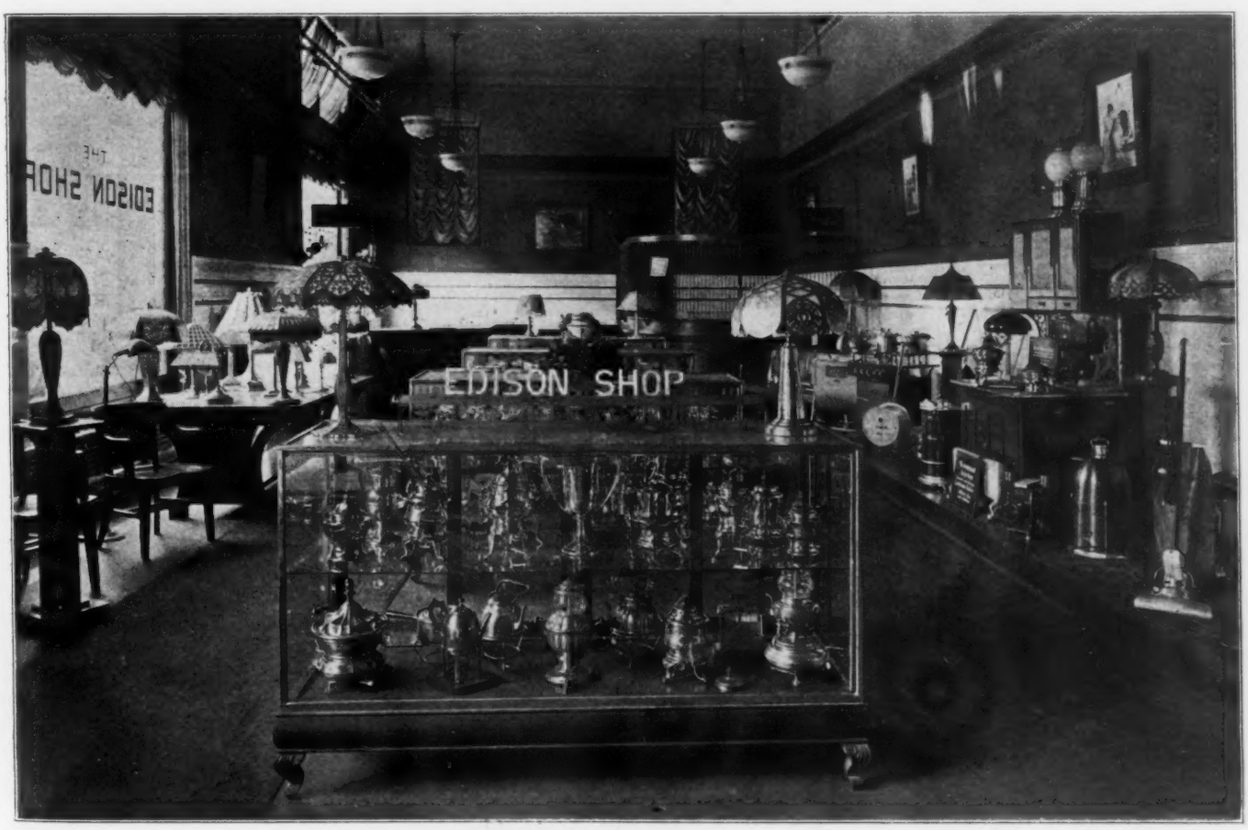


FIG. 4—BROOKLYN EDISON SHOP, WHERE MERCHANDISING IS CONDUCTED ON A MERCHANDISING BASIS

in the right direction by securing a room with a show window on the street, putting in good shelving and counters with a showcase on one side and a flat counter on the other. A small fixture room usually brought up the rear, and a shop for rough work was installed on the alley. At first great care was taken to keep everything clean and in order; ladders and material were carried in and out the back door, etc. But before ninety days the store became the hang-out of idle workmen, and cigarette smoke and tobacco juice were always in evidence. Showcase and counters became the catch-all for timers, tools, gloves, pipes, blow-torches and even overshoes and rubber coats. The show window was made the temporary resting place of half-unpacked breakable things to be delivered later; the space between counters was after a while the most convenient place to unpack fixtures and glassware, and the step-ladder invariably was left resting against the counter bearing the showcase.

What an inviting place for a woman to shop! If one did come in, probably the man who knew how to wire houses would throw off his hat and appear behind the counter in his shirt sleeves, with a dirty collar or no collar at all and a Wednesday growth after a Sunday shave, and say, "Did you wish something?" Probably the lady did previously wish to buy something electrical, but at the moment wished that there was a more respectable place—at least, a more inviting place—where she could purchase electric appliances.

Effect of Slip-Shod Merchandising Methods

The slip-shod, careless, wait-for-the-dollar methods of most retail electrical business establishments have undoubtedly retarded the growth in popularity of electricity in meeting not only the luxuries but the comforts and necessities of every-day life. And had it not been for the intervention of progressive manufacturers, who forced electrical devices into other branches of the electrical trade, the business would have suffered more than it has.

Electric light and power companies have in most cities dodged the responsibility of supplying electrical appliances to their customers, leaving the field to poorly conducted electric supply stores, department stores, hardware stores, etc., the owners of which in many cases do not know the value or reliability of an electrical device. This has resulted in the sale of unreliable and in some cases hazardous appliances. A protection against such abuses would be the handling of the business by persons competent to pass upon the merits of the device before it is offered to the public. There is no good reason why a lighting company should operate a retail business at cost. Neither is there any good reason for abandoning the business to incompetent people. For the companies owe it to the people as well as to the electrical interests at large to see to it that well-conducted stores or electric shops are provided for the sale of safe, dependable electrical materials of quality to match the dollar paid.

Many of the greeds that have crept into the business have come as a result of ignorance on the part of the retail purchaser. In the purchasing of other things one can, in a measure, protect himself, for everyone has some knowledge of clothing, shoes, hardware, groceries, etc., and can tell when fish is bad by smelling it. But all the senses will not protect the layman against the purchase of inferior electric appliances or of improperly selected appliances for the purpose intended. He must depend upon the honesty as well as the knowledge of the man who sells the devices to him. The electric-light company knows its own system and the apparatus best suited to it and to the needs of the customer so far as reliability is concerned.

The Jobber's Relation to the Manufacturer and Contractor

So much has been said and written on co-operation that one almost forgets the reason for the inception of the thought which the word expresses. Co-operation represents the tendency of the times and in addition lends itself to blind imitation without regard to its real reason as a business tool. Co-operation should be selfish in its origin. There is nothing criminal in legitimate selfishness, since all real ideas are of this nature, and when judiciously applied they result in general benefits which are nothing but an amplification of the same idea.

The jobbers' association is justifiable just in so far as its acts for the good of its individual members and for the welfare of the jobbing trade. Any legitimate steps it has taken in this direction are admirable. There is little doubt that it has accomplished much, for there seems to be a betterment in the industry, more efficient methods are discernible and diminished friction generally obtains—the result of healthy businesses getting together and settling their differences. One cannot reflect on such an institution as the jobbers' association is or might be without realizing its great possibilities in the uplift of the entire field if it chooses so to act as an organization.

The jobber is so intimately connected with the manufacturer, the contractor, dealer and consumer that it is hard to think of one without the other. The improvement of any of these means the expansion of the jobber's business. Of the classes with which the jobber has relations the two most intimate are the manufacturer and the contractor. The former is basic to the industry and hence to the jobber, and the latter is at present the creative agent involved in all new operations having in view the utilization of electricity.

The Jobber and the Manufacturer

In cultivating the manufacturer further co-operation by the jobber seems possible. In this the jobber has his best chance to prove that he is a creative force in the industry, in producing business, rather than in merely handling it. The manufacturer is in business first to make and then to market his product. He must be convinced that there is an economical way to do the latter and that is through the jobber, who in his capacity as such can reduce financial risk, increase demand, fine-comb a local territory and cut sales costs. If the jobber can't or won't offer such service to the manufacturer, the latter must resort, naturally, to other channels of distribution because he is bound to sell his goods. The familiar complaint of the manufacturer that he is asked by the jobbing trade to create the demand for his goods before he can talk business is not the ideal condition. It looks as if one man were doing all the work. Yet present conditions make it hard for either to act differently if they are ultimately to do business. From the manufacturer's standpoint this treatment calls for a little patience and to the jobber it seems perfectly reasonable. The former believes that in making a good article, advertising it well and backing that up by good missionary work, he has completed the economic cycle and that its reception by the jobber should be automatic. The latter claims, on the other hand, that the cost of carrying many lines is prohibitive and risky. Buying conditions generally make a settlement on this score difficult because of broken and standard package prices, service charges on pick-up shipments, faulty deliveries and many other complications too numerous to mention. In effect, the present arrangement, while coercive and ultimately successful

from the manufacturer's standpoint, defeats good feeling and incurs resentment. How much better if every line, new or old, were in a position to prove itself by orders coming over the jobber's counter and were backed up by the manufacturer until the goods were automatically purchased in bulk by the jobber as a staple product! Here is a chance for the jobbers' association to act with the manufacturer. Co-operation in this respect would eliminate to a great extent the substitution of an article other than that called for, which is the sorest spot in the manufacturer's anatomy, and result in much good for all. A few measures of this kind and the undesirable jobber, cut-throat, etc., would pass into history since the cause which gave them being would have disappeared. Alternatives are resorted to only when direct methods fail. If the same energy could be exercised in supplying what is asked for that is now expended in remembering what is on the shelf, business would gravitate to the place where complete service is to be had. The manufacturer would then be represented wherever the shingle "Electrical Supplies" is seen, and the jobber would become a creative and an indispensable institution. The manufacturer should know all about the jobber, what he is doing and how he does it. When such a condition obtains, mystery vanishes, doubt and fear are dispelled, and differences are thrashed out in the open.

Relations with the Contractor

The cultivation of the contractor will strengthen the jobber's position if worked out on a large scale, as local adoption of this policy in a few places has proved. The contractor has lately set about looking after his own interests and great things have already been done through the National Electrical Contractors' Association. As a class the contractor is working toward real issues and has much to be proud of in his association organ. The fact that the contractor is organized makes the jobber's problem all the easier, and it is well that this is so, for it is difficult at best.

Electrical contracting is a business of many troubles because it is harassed by vicious competition and destructive price-cutting. The contractor is continually fighting an estimate sheet and labor problems and is often compelled to sell material at cost and be satisfied to gamble on the labor and extras as a margin. But better things are in store for him, and the time is passing when he looks to the bank for his payroll, to the jobber for his credit and to Providence for his profits. He is entitled to a better price on material than the consumer, because he gets but one chance usually to sell, and he also assumes the responsibility for his purchases, often storing them and accepting the risk in handling and depreciation on unfinished work. So long as the handling of material means trouble and no pay, just so long will the contractor look on the source of trouble with tolerance and continue to speculate at the jobber's risk, talk price, and refuse to expand in a beneficial trade direction toward creative sales of things electrical. He is often in a position to recommend changes, improvements and expenditures at an opportune time, when the job is in construction and the customer's mind is open to suggestion. He could oftentimes sell many things at almost no expense to the jobber, but if there is not sufficient recompense he cannot be expected to extend himself. The jobbers' association and the contractors' association are so important in themselves and mutually that co-operation here can almost be said to be limitless.

The contractor is becoming more methodical and businesslike in his dealings. He appreciates more keenly than some jobbers what overhead charges mean and is also more willing to co-operate.

Shall Free Lamp Renewals Be Discontinued?

Supply dealers, jobbers and some few manufacturers of incandescent lamps are endeavoring to focus attention on the free-lamp-renewal policy of electric-light companies with a view to having the practice discontinued. The claim is made that lamps of inferior quality are no longer on the market so that central-station supervision over the lamp supply of customers is not now necessary. It is hoped to attack the policy on the ground that public service laws do not permit discrimination, and that inasmuch as the policy of free renewals of incandescent lamps is pursued at a loss so that those customers who do not use lamps have to bear the burden, discrimination is shown. Those who hold this belief maintain that the function of the electric-light company is to sell electrical energy, to disseminate information on the scope, use and desirability of electrical appliances, the proper method of installing and the economical use of electric lamps. In short, the lighting company, because the sale of its product is perpetual, should create business for those concerns legitimately engaged in the sale of electric lamps and appliances because such co-operative effort would give even greater returns. The hope is expressed that public service commissions will stamp out the practice.

Central-station managers, however, are not sanguine of such an outcome and insist that the day has not yet come when lighting companies should cease to exercise supervision over the lamps connected to their circuits. They deem it a part of the service to see that customers receive proper light at minimum cost so that central-station supply shall not fall into disrepute. Indeed, the movement is not taken seriously at all. One prominent central-station manager characterized the idea as preposterous. In the first place, he said, the Public Service Commission law gives the commission explicit supervision over the efficiency of the electric incandescent lamp supplied. Moreover, it is to the advantage of the public to receive the very best lamps of highest efficiency at minimum expense so that the cost of illumination shall be a minimum. With control of the lamps by the central-station companies they are responsible to the public that this shall be so. They have experienced the necessity of testing the lamps being supplied to their customers and would not be prepared to leave the consumer without this safeguard. They do not sell lamps except to customers taking energy from their circuits, and the supply of lamps, repairs, etc., is part of the service they render.

Price-Cutting by Jobbers

One subject which might be discussed by the electrical jobbers at their annual meeting in Washington next week relates to the cutting of prices by jobbers and jobbers' salesmen. Some of the large supply houses have been giving especial attention to this matter of late, and they feel that although they do a large volume of business the margin of profit is unsatisfactory. Even in the lines of electrical supplies bearing comparatively large margins of profit, a reduction in price of 5 per cent means an actual reduction in profit of from 20 to 33 1/3 per cent. Some of the large dealers are endeavoring to impress these facts on the minds of their salesmen, for some of the latter, particularly those less experienced, do not recognize the significance of these apparently small reductions in the price of electrical supplies unless the facts are brought forcibly to their attention. It is possible, too, that some of the jobbers themselves will receive no harm from devoting careful study to the arithmetic of the situation.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Fire-Alarm Sending and Indicating Apparatus

The Guide Fire Alarm Company, Brooklyn, N. Y., manufactures an electrical device for transmitting fire-alarm signals and automatically indicating the point from which the alarm is sent. These alarm boxes are especially adapted for use in industrial establishments and other places where it is desirable to have the location of the fire indicated at each alarm-sending station. When a fire-alarm system consisting of several of these devices is employed there is no possibility of the signals being confused when two alarms are sent simultaneously, as may occur with the single-stroke bell alarm.

INTERIOR AND EXTERIOR VIEWS OF FIRE-ALARM-SENDING AND GUIDE BOX

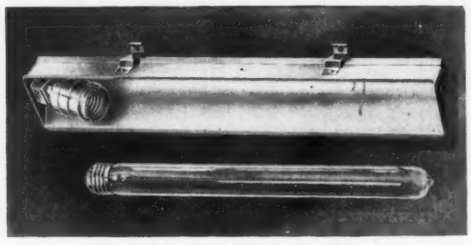
Illustrated herewith are two views of one of these boxes: The upper is an exterior view showing the alarm bell and annunciator numerals; in the lower view the cover is removed, showing the lamps within. On each box is a small glass door equipped with a lock which when opened or broken rings all of the alarm bells on the system, at the same time indicating the location of the sending box by lighting one of the red-glass figures on the front of the box. As the figure remains illuminated after an alarm is given, it is not necessary to understand a bell code to locate the fire. Signals can be sent simultaneously from several boxes without interference or confusion and are indicated by the lighted numerals. The lamps which illuminate the figures are wired in series with a closed-circuit relay which operates a trouble bell if a filament burns out or a connection becomes loose.

The sending stations can be installed separately from the guide boxes, and the latter may be placed near the ceiling where they can be readily seen from several directions. A guide box may also be located on the outside of the building near the entrance to inform entering firemen of the box from which the alarm was sent. Storage batteries may be used to operate these signals, but the manufacturers recommend connecting them to 110-volt electric-service wires.

Tubular Lamp for Showcase Lighting

A tubular showcase-lighting unit, illustrated herewith, has been placed on the market by the Holophane Works of the General Electric Company. The lamp is 1 in. in diameter, and the distance from the contact of the medium screw base with which it is equipped to the top of the lamp is 12 in. By means of the medium screw base the lamp can be fitted to an ordinary socket. A single drawn-wire tungsten filament extends practically throughout the entire length of the bulb, thus providing a running line of light. In order to make this length of filament of high enough resistance to be used on ordinary lighting circuits, the filament itself is twisted into a very fine spiral. The lamp is made in both 25-watt and 40-watt sizes.

The brass reflector, when in position in the upper front angle of the showcase, occupies a space 14 in. long, 2.5 in. wide and 2 in. deep. It has an interior finish of Cleanezy aluminum. The contour of the reflector is designed to present a neat appearance, to give the most effective distribution of light and to shield the eye from the high intrinsic brilliancy of the lamp filament. The unit is readily installed by raising the glass top of the showcase, supporting the reflector from the upper edge of the upright glass by means of two brass brackets, and then lowering the top. The two brass brackets are made to fit the thickness of the plate glass ordinarily used in showcases. The lamp socket is mounted on a hinge. This facilitates the removal or insertion of the lamp after the reflector is installed. In order that the lamp may not swing out of the reflector when in use, it is held rigidly by a wire clasp fixed to the reflector near the tip end of the lamp. A series of these reflectors



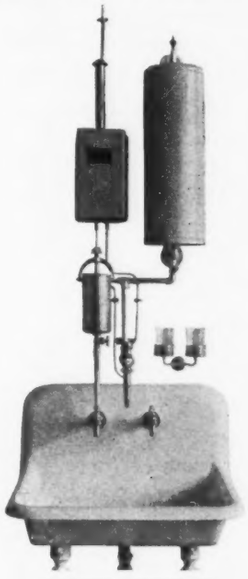
TUBULAR LAMP WITH BRASS REFLECTOR FOR SHOWCASE LIGHTING

can be used along the entire upper front edge of the showcase, close enough together for no open intervals to be left, or the units may be placed at certain intervals along the case. If placed close together, a sliding brass molding on the back of the reflector protects and conceals all the wiring. If the units are placed at intervals, short lengths of round brass tubing may be used to conceal the wiring between the units.

Compact Water Ozonizer

In the accompanying illustration is shown a compact water ozonizer and filter manufactured by the Held Company, Chicago. The filter is an accessory which is furnished only when solid matter suspended in the water has to be removed. Sterilization is accomplished by automatically spraying ozone through the water as the latter traverses a mixing chamber attached to the faucet. The ozone generator may be supported on the wall as shown and operates only when water is being drawn from the faucet, being supplied with electricity from a lamp circuit or storage battery. Two tubes permitting a circulation of the ozone connect the ozone generator with the mixing chamber. At the prevailing electric service rates, it is declared that 200 gal. of water can be sterilized for 1 cent with this apparatus.

The effectiveness of this apparatus in destroying bacteria has been tested in several laboratories. Chicago city water containing from 150 to 270 bacteria per cu. cm, was rendered perfectly sterile with this apparatus, it is claimed. Later water containing over 1,000,000 colon and typhoid bacteria was also sterilized. The average of several tests on the ozone developed by the generator revealed 58 parts of ozone in 10,000 parts of air.



WATER OZONIZER

Other tests showed the following bacteria content before and after ozonization:

	No. of Bacteria per Cu. Cm. Before	No. of Bacteria Per Cu. Cm. After	Per Cent Reduction
Unfiltered lake water inoculated with:			
Colon	2100	0	100.00
Typhoid	6800	1	99.99
Typhoid (second test)	5600	0	100.00
Dysentery	4100	0	100.00
Distilled water inoculated with:			
Colon	1900	0	100.00
Typhoid	4400	0	100.00
Dysentery	3800	0	100.00

The "Aero" Cable Car

The Aero cable car, described on page 280 of the *Electrical World* for Jan. 31, has been placed on the market by the Fairmount Electric & Manufacturing Company, Philadelphia, Pa.

Electricity in a Louisiana Sawmill

A number of interesting uses are made of electricity in the huge plant of the Industrial Lumber Company at Elizabeth, La., which has a daily output of 300,000 ft. of lumber, corresponding to the "cut-over" of about 20 acres of land per day. Bark and strippings from the sides of logs are in most mills carried to cupolas and burned. At Elizabeth, however, this material is run through "hogs" (large electrically driven, high-speed cutters) which shred the strippings, preparing them for the turpentine boilers or vats where turpentine is extracted from the wood by a process of steaming.

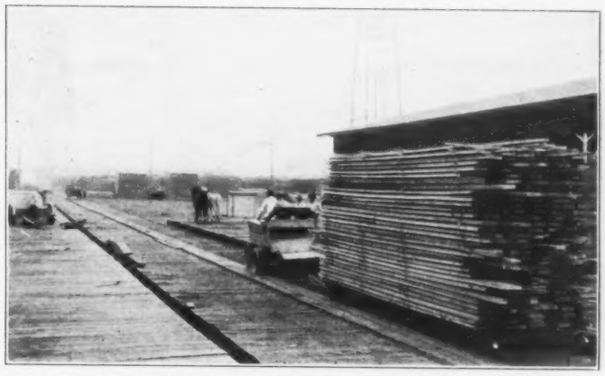


FIG. 1—ELECTRIC TRACTOR AND LOAD OF LUMBER

About 15 per cent of the output of the plant goes to the dry kilns, while, except for the rough stock, most of the remainder is piled in stacks and put through the planers. The matter of moving this lumber formerly required about twenty mules and a corresponding number of men, but the work is now performed with marked savings by the battery-driven tractors illustrated herewith. As will be noted from Fig. 1, the battery is mounted on the top of the 2-ton chassis, the driver's seat being at the rear. The lumber is first loaded on a standard two-wheel lumber "dolly" which is connected to the tractor by backing the latter under the lead. A chain is thrown across the lumber back of the first cross-bar, and by pressing a lever an electric hoist tightens the lumber to the "dolly" and holds it securely to the rear bolster.

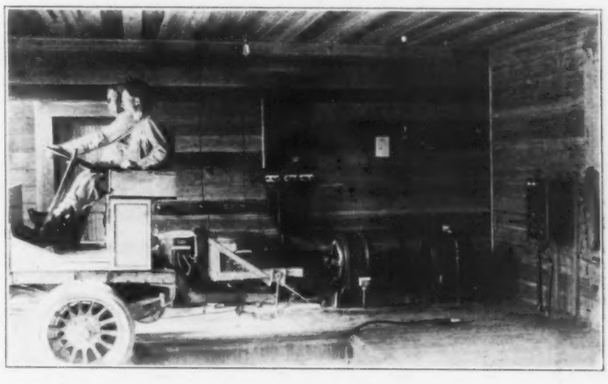


FIG. 2—BATTERY-DRIVEN TRACTOR AND CHARGING EQUIPMENT

In moving the lumber from the mill to the lumber stacks, the tractor has a capacity of seven and one-half round trips (2400 ft. each) per hour, towing an average load of 1500 ft. of lumber, or 3.375 tons. In this work one of these General Vehicle tractors displaces five mules and three men.

Connecting the mill with all parts of the yards are some 5 miles of wooden tramways, each 16 ft. to 20 ft. wide and floored with 3-in. lumber. When mules were used for haulage it cost about $25,000 to renew this flooring every three years, but the wear occasioned by the present rubber tires is, of course, negligible.

After the lumber has been dried it is removed to the planing machines. This work proved extremely hard on the mules, but with the present electrical equipment one tractor is able to displace seven mules and five

COMPARISON OF OPERATING COSTS WITH MULES AND ELECTRIC TRACTORS

Investment	Mules	Tractors
Sixteen mules at $225 each	$3,600	
Twenty sets harness at $25 each	500	
Twenty two-wheel "dollies" with shafts, at $25 each	500	
Three electric tractors with batteries at $2,900 each		$8,700
Stable, grain, horse, blacksmith shop, etc	3,000	
Garage, charging apparatus, etc		1,000
Total	$7,600	$9,700
Fixed Charges		
Interest	$228	$291
Depreciation	1,140	1,020
Fire insurance	100	87
Total fixed charges per year	$1,468	$1,398
Operating Costs		
Renewals of batteries (every year)		$867
Renewals of tires (every year)		600
Renewals of chains, gears, etc		375
Feed, shoeing, stable help, etc., at $20 per month per mule (sixteen mules)	$3,840	
Labor, at $1.75 per day	10,560	3,600
Repairs to tramways	8,550	4,275
Total operating costs per year	$22,890	$9,717
Total costs per year	$24,358	$11,115
Saving per year by using electric tractors		$13,243

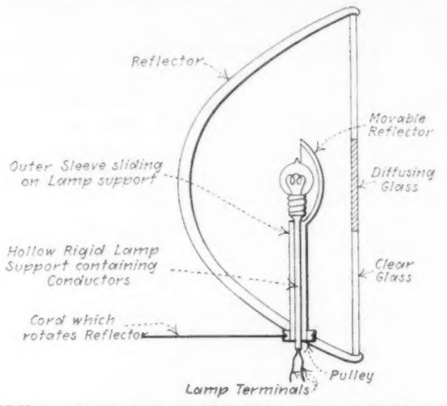
men and can make thirteen 2000-ft. round trips per hour, carrying 1000 ft. of lumber per trip. The accompanying table gives comparative figures for the cost of operating three tractors, with six men, replacing sixteen mules and twenty men. In arriving at this result the cost of charging energy has not been included, as the amount required was considered negligible. Assuming that energy could be purchased at 4 cents per kw-hr., this item will not average over $200 per tractor.

Electric Head-Lamps for Use in Country and City

To meet the requirements of city ordinances forbidding the use of dazzling head-lamps, and at the same time to furnish lamps with penetrating beams for use on country roads, C. & A. Matisse, New York, have brought out a head-lamp with an internal mechanism which eliminates the necessity of two lamps having different intensities.

The head-lamp consists of the ordinary inclosing case and a special reflector with a concentrated-filament lamp and a small-diameter reflector supported on a movable vertical rod passing through the focus of the large reflector. Supported on a rigid pedestal at the center of the flat-glass lens sealing the front of the fixture is a diffusing lens of small diameter. The arrangement of these parts is shown in the accompanying diagram. The lamp and small reflector can be simultaneously rotated through 180 deg. by pulling a flexible steel cord passing around a pulley at the base of the movable, vertical lamp-support. By so doing the light from the lamp can be directed against the large reflector for use on country roads, or it may be entirely shut off from the large reflector and softened by the small diffusing lens.

These head-lamps can be furnished with plain silvered reflectors or with specially prepared reflectors which reduce glare. By using this head-lamp on automobiles it is unnecessary to provide side-lamps, and the



AUTOMOBILE LAMP FOR PRODUCING TWO KINDS OF LIGHT INTENSITY

car wiring is simplified by having only one source of light in the head-lamp instead of two. In addition, it is not necessary to get out of the car when entering a city to put diffusing screens over the head-lamps.

Arc-Lamp Bracket and Cross-Arm

The accompanying illustrations show the arc-lamp brackets and cross-arms which have been adopted by the Sanitary District of Chicago and which have been used thus far for the suspension of over 8000 lamps.

FIG. 1—MALLEABLE-IRON CROSS-ARM

The design of the brackets incorporates the inverted "Y" which is Chicago's municipal emblem. The cross-arms are made of malleable iron and are used to carry the arc-lamp conductors. The arms fit on the projec-

FIG. 2—ARC-LAMP BRACKET

tions shown on the top of the brackets. Steel pins carrying porcelain insulators are used with these arms. The brackets and cross-arms are manufactured by the Line Material Company, South Milwaukee, Wis.

Jobber, Dealer and Contractor

Detroit Contractors and Supply Men Organize

With elimination of certain trade abuses as one of the objects sought, a number of Detroit (Mich.) electrical contractors and supply men have organized the Detroit Improvement Association and elected the following officers: President, Mr. Alfred Moore; first vice-president, Mr. L. B. Reece; second vice-president, Mr. H. E. Ford; recording secretary, Mr. M. T. Green; financial secretary, Mr. F. A. Chapman; treasurer, Mr. W. F. Miller; sergeant-at-arms, Mr. Thomas Walters. The organization will endeavor to adjust trade differences, both general and individual, keep members informed of local conditions, raise the standard of electrical construction, promote a more friendly feeling among members of the trade and supply members with accurate information as to the standing of builders or others engaged in construction work.

St. Louis Jobbers' Outlook Bright

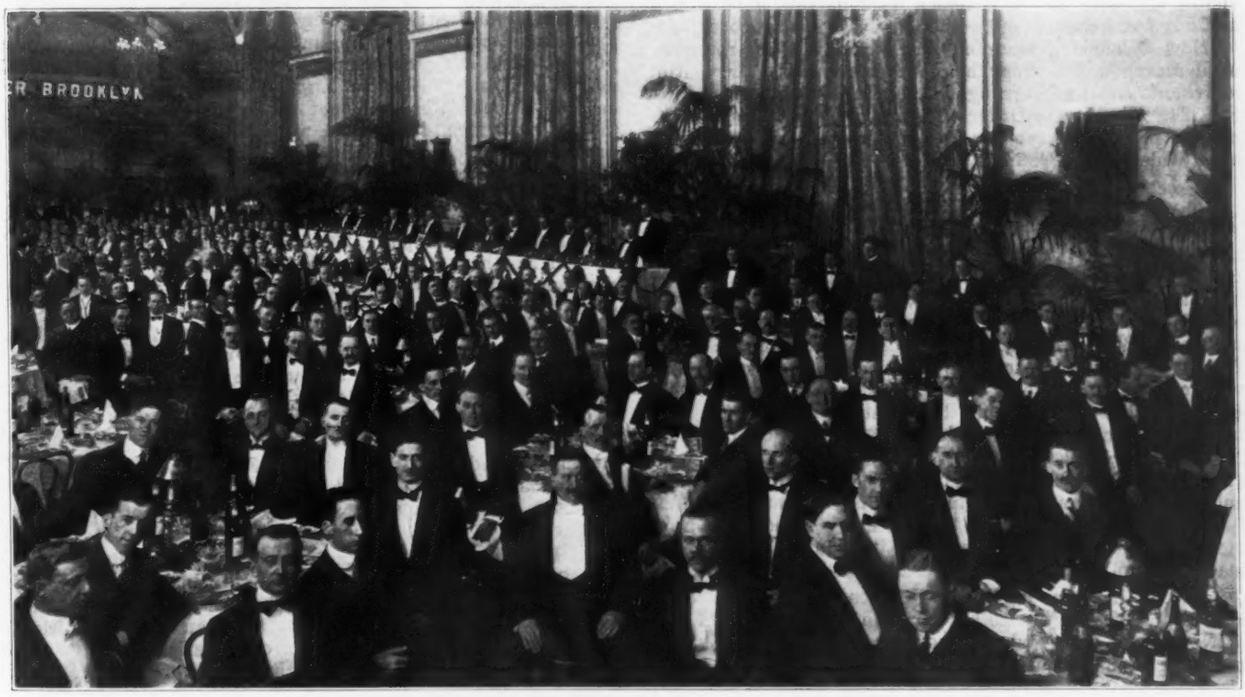
Territory tributary to St. Louis, Mo., harvested bumper crops in 1913, establishing basic prosperity in which the electrical jobbing interests of the city hope to share. Judging from the January business, Mr. Burt Crouch, of the sales department of the Western Electric Company, predicts that the supply business of 1914 will make a steady and substantial increase over that of last year. The company's business in St. Louis for 1913 was good and showed a comfortable increase over 1912, which rather indicated that the supposedly general financial depression had not reached the purchasers of electrical supplies in and near St. Louis.

Mr. Charles Scudder, of the Wesco Supply Company, in an interview with a representative of the *Electrical World* stated that the outlook for the coming year was bright. Everything seems to point toward the fact that the low point on the "financial-depression curve" was passed about Jan. 1, 1914, the general trend of that interesting graph now being markedly upward.

Responsible jobbers in St. Louis are co-operating with contractors and retail dealers respecting the interests of those concerns which sell to the general public, although there is no price agreement. Many jobers do no retail business at all.

Brooklyn Contractors Dined by Edison Company

The eighth annual dinner to Brooklyn electrical contractors by the Edison Electric Illuminating Company of Brooklyn was held at the Academy of Music on Feb. 7. More than 300 contractors drank to the toast of a bigger, better, brighter Brooklyn, and the occasion was the most successful and largest of the yearly love feasts given by the electric company. Mr. T. I. Jones, the general sales agent of the company, acted as toastmaster, and addresses were made by Mr. W. F. Wells, vice-president and general manager of the company, whose subject was "The Edison Company"; Mr. Louis Kalischer, president of the Electrical Contractors' Association of Long Island, on "Wiring Brooklyn"; Hon. L. H. Pounds, Borough President, who told of "The Borough's Future"; Mr. J. R. Strong, past-president of the National Electrical Contractors' Association, whose topic was "The Society for Electrical Development"; Mr. J. C. Forsythe, chief inspector of the New York Board of Fire Underwriters, who told of "The Work of the Board of Underwriters," and Mr. F. W. Conn, to whom was assigned the subject of "Industrial Brooklyn." During the dinner and between speeches songs were sung with a relish, and the whole occasion reflected the very cordial relationship existing between the electric-light company and the contractors of Brooklyn. The opportunities existing for the electrical contractors, the willingness of the electric company to relieve them of the financial responsiblity of carrying customers of good credit and its desire to help and co-operate in every way were outlined by both Mr. Wells and Mr. Jones.



DINNER OF EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN TO LOCAL ELECTRICAL CONTRACTORS

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Recent Sales of Gas Engines.—Among the larger gas engines sold recently by the Bruce-Macbeth Engine Company, of Cleveland, Ohio, an aggregate capacity of 615 hp was taken by the following concerns: The Ohio & Pittsburgh Milk Company, Pittsburgh, Pa.; the Odenweller Milling Company, Ottoville, Ohio; the Washington (Pa.) Milling Company; the Hoefler Ice Cream Company, Buffalo, N. Y.; A. H. Koughan, McKeesport, Pa., and the Consumers' Paint, Shale & Gas Company, Perry, Okla.

Ice Plants Using Central-Station Energy.—Ice plants aggregating 4841 hp are connected to the mains of the Commonwealth Edison Company, Chicago. Fourteen different plants owned by eleven companies have made contracts for energy with the electric-service company. The daily tonnage output for the various plants ranges from 60 tons to 140 tons, totaling 1245 tons. The largest electric ice plant in Chicago is that of the Consumers' Company, at East Sixty-first Street and University Avenue, where motors rated at 564 hp are installed.

Carnival Spring Buyers' Convention in New Orleans.—The Carnival Spring Buyers' Convention of the Merchants and Manufacturers' Bureau of New Orleans will be held in that city on Feb. 16 to 24, inclusive. It is understood that the Merchants and Manufacturers' Bureau of New Orleans will refund the round-trip railroad fare of any merchant who goes to New Orleans and purchases goods to the value of $500 or more from members of the bureau, provided the visitor registers at the bureau's headquarters upon arrival and has purchased a round-trip carnival-rate railroad ticket to New Orleans. The round-trip ticket is good returning until March 6. A program of entertainments for visiting merchants has been arranged, including the Rex parade on Feb. 24. The Jovian Order will give a "Jovian Night" celebration in New Orleans on Feb. 21, and entertainment will be provided for all visiting Jovians.

Diesel Engines to Be Made in Los Angeles.—According to the daily newspapers, the Union Tool Company, of Los Angeles, has acquired exclusive rights for the manufacture of Diesel engines of the type made by Baumeister & Wain, Copenhagen, Denmark. The contract is reported to have been made by the Los Angeles company with Andrew Weir and J. Tilden Smith, of London, representatives of Baumeister & Wain. It gives the exclusive right for the manufacture and sale of the Diesel engine of this type on the west coast of North and South America, the rights for the United States including all the territory west of the Mississippi River. It is said that the paid-up capital stock of the Union Tool Company will be increased at once from $1,200,000 to $2,500,000, and that $500,000 will be spent in enlarging the plant at Torrance. It is stated further that I. Knudson, of Copenhagen, the managing director of Baumeister & Wain, will oversee the installation of the new machinery in the Los Angeles factory.

Series of Lectures on Public Utilities Planned.—Through joint action of the Finance Forum of the West Side Y.M.C.A. in New York City and some of the leading banking, engineering and operating interests connected with public utility matters, a series of ten lectures has been arranged to cover the questions of public utility organization, management and financing, together with construction and operation. The lectures are designed to induce, through better knowledge, a rational public opinion concerning utilities, particularly as it may affect legislative and regulatory action, and to give a better idea concerning the stability and value of public utility securities. The lectures are to begin the latter part of the present month. C. B. Wilcox has been selected as permanent chairman of the general committee in charge of the course of lectures, and included in the membership of the committee are A. W. Burchard, A. H. Bickmore, H. F. Davison, H. L. Doherty, Lewis Franklin, R. H. Griscom, A. G. Hoyt, H. R. Hayes, W. M. Kingsley, A. L. Kramer, A. B. Leach, S. Z. Mitchell, Ray Morris, W C. Poillon, Seton Porter, J. H. Pardee, Calvert Townley, H. A. Viele, F. C. Walcott, J. C. Weadcock, G. C. White, R. K. Wilsey, C. B. Willcox, W. B. Dinsmore, F. T. Homer, J. H. Rhodes and James Sheldon. The lectures will be given in the auditorium of the West Side Y.M.C.A.

Electrical Tool Manufacturer Increases Capitalization.—An increase in the capital stock of the Eveland Engineering & Manufacturing Company, of Philadelphia, Pa., has been authorized by the board of directors for the purpose of extending its business. According to S. S. Eveland, president of the company, the new capitalization will be $2,000,000 in place of the present figure of $100,000. In the *Electrical World* of Aug. 9, 1913, note was made of an increase in the company's manufacturing equipment and of a large contract placed with the firm of Manning, Maxwell & Moore, involving the sale of an entire year's production of Eveland electric riveters.

Industrial Use of Electricity in Springfield (Mass.) District.—The Amherst Power Company, an organization affiliated with the Turners Falls Power Company and other Cabot properties in Massachusetts, has recently extended its service through the Connecticut Valley to include many industrial plants in the Springfield district. Among the company's customers are the Fisk Rubber Company, 3000 hp; Springfield Street Railway, 2000 hp; Chicopee Manufacturing Company, 750 hp, and the Page-Storm Company, 400 hp. The Amherst company has entered into a contract with the United Electric Light Company of Springfield whereby the latter will act as a distributing agency, handling a normal load of about 2000 kw. On the west side of the Connecticut River the local service is handled by the Agawam Electric Company, and energy is supplied to the West Springfield water-works pumping plant to the extent of 150 hp; to Lane's quarry, Westfield, 200 hp, and to the Ramapogue Ice Company, 300 hp. About 600 kw is utilized by the Northern Connecticut Light & Power Company in supplying service to Thompsonville, Windsor Locks and other local communities. When present power developments are completed on the Connecticut River, the company will be able to generate about 50,000 hp in its hydroelectric plants. The lines of the company are carried on about 500 steel towers and are designed for ultimate operation at 66,000 volts. The standard towers are 75 ft. high and are mounted on concrete piers. Important hydraulic developments are under way at Turners Falls, Mass., and allied companies in Greenfield and Easthampton are co-operating with the Amherst system in the distribution of electrical energy.

To Investigate South American Trade Possibilities.—On Feb. 7 thirty-seven members of the Illinois Manufacturers' Association sailed from New York, bound for South America, where an extended survey is to be made of the possibilities of that continent as a consumer of American goods. As stated in the Nov. 2 issue of the *Electrical World*, this delegation was headed by E. N. Hurley, of Chicago, president of the Hurley Machine Company, who was appointed by Secretary Redfield of the Department of Commerce as United States trade commissioner to South America. The party will visit Brazil, Argentina, Chile and Peru and will look into questions of financial as well as of industrial and commercial importance. It appears that a large part of the banking system in the above countries is controlled by English and German interests and, as the facilities provided by these banks are necessary to the carrying on of trade relations, this state of affairs immediately places the

American exporter at a disadvantage in competition with the English and German exporters. The following statement by Mr. Hurley, on the eve of his departure, is worth noting: "It is a mistake for American business men to think that England and Germany have the South American trade so closely in their grip that there is no opportunity for the business men of the United States to obtain a large share of it. The people are there and the money is there. The field is a tremendous one, but the conditions there have never been properly studied, nor have plans been put into operation that would make it possible to increase the commerce between those countries and the United States."

Electric Furnaces for Steel Manufacture.—In the Jan. 24 issue of the *Electrical World* a note appeared concerning the construction of a new plant at Indianapolis by the Electric Steel Company of Indiana. The plant at present under construction will have a capacity of about 14,000 lb. of finished castings per day. The furnaces now being installed and those proposed for the future are the latest type of Buckman arc smelter. The unit under consideration will draw about 300 kw. Energy will be purchased from the local public service company and will be stepped down from 4100 volts to 110 volts. Three-phase, sixty-cycle current will be employed. Three single-phase transformers of 200-kw rating each (allowing 100 per cent overload) will be used to step down the voltage. These will be furnished with tap regulation, so arranged that the current may be furnished to the furnace at practically any voltage from 5 to 110. This allows, with the mechanical devices of the furnace, absolute control of temperature. The Buckman smelter is especially designed to reduce losses from self-induction and is thus able to operate efficiently on sixty-cycle, 110-volt, three-phase current. This makes possible the economic use of the usual equipment of public service plants, which is a very important feature for both the producer of power and the foundryman.

Two Thousand Men at Banquet of Hawthorne Works Employees.—The fifth annual banquet of the Hawthorne Works men employees of the Western Electric Company was held at Medinah Temple, Chicago, on Feb. 4. The attendance was very large, numbering about 2100. As the attendance at the 1913 banquet was 980, the increasing popularity of this annual event is indicated. S. S. Holmes, president of the Hawthorne Men's Club, was toastmaster and the speakers at the dinner were H. F. Albright, general superintendent of the Hawthorne Works, and J. W. Bancker, assistant general superintendent. Medals were presented to the prize winners of last year's athletic contests in which the Hawthorne men participated. Following the dinner a vaudeville entertainment by professional talent was given in the main auditorium of Medinah Temple. The affair was attractively and persistently advertised in the various departments of the Hawthorne Works before the event, and it assumed such great proportions that the Hawthorne men styled it "our big night." Thirty-six special surface cars were provided to take those in attendance for the long ride from the Hawthorne Works to Medinah Temple. It was the ambition of the Hawthorne employees to make this annual dinner the largest and most successful affair of the kind ever attempted by any organization, and they may have succeeded. Nine hundred pounds of beef and 1200 lb. of chicken were needed. The banquet was held under the general supervision of the works central committee, of which C. J. Malmros is chairman, and was arranged and managed by the Hawthorne Men's Club, J. A. Dietz being chairman of the executive committee. F. J. Sheridan was chairman of the arrangement committee of the club and M. K. Roewade was chairman of the publicity committee.

Electrical Features of New Omaha Hotel.—Omaha is to have a fine, modern hotel in the Hotel Fontenelle, which is to be built by the Douglas Hotel Company at the northwest corner of Douglas and Eighteenth Streets. The excavation has been made, and the Selden-Breck Construction Company, of St. Louis, has the general contract for the building. Mr. Thomas R. Kimball, of Omaha, is the architect, and Neiler, Rich & Company, of Chicago, are the consulting electrical and mechanical engineers. The building will contain over 300 rooms and will consist of fifteen stories, besides the basement and attic. The ground plan is 132 ft. square. The building is well designed, both inside and out, and the hotel will be provided with all modern improvements, including some new features, such as lounging rooms on the two floors devoted to sample rooms for commercial travelers and key chutes by which keys to guest rooms can be returned to the clerk's desk if overlooked. There will be five electric elevators of the traction type, two of which will be for passengers. Electricity will be used exclusively for lighting and for many mechanical purposes. The lighting load will consist of about 250 kw and the motor load of about 223 hp. Central-station energy will be purchased, probably, from the Omaha Electric Light & Power Company, although space is provided for an electrical generating plant if one should be installed later. Direct current at 500 volts will be used for elevator and fan motors, and three-phase alternating current for general motor purposes, including laundry machinery. Electric signs will be a feature of the building and are incorporated in the general architectural plan, so that in daylight the signs will not give the appearance of something extraneous to the general building design. Fronting on each street there will be large roof signs giving the name of the hotel, the letters being 5 ft. 8 in. high. In addition there will be electric signs over the marquises or sidewalk canopies. Special illumination will be provided for these marquises, and another interesting feature in the illumination is a provision for lighting, by reflected light from above, the skylight over the main lobby, so that it will present a warm and pleasing appearance at night, obviating the cheerless effect often associated with skylights after dark. The corridor lighting will be provided by lamps supported on bracket fixtures, it being thought that ceiling fixtures have a tendency to magnify the apparent length and height of hotel corridors. In the dining room and palm room removable ceiling fans will be provided. Telephones will be installed in all the guest rooms.

Statement of the Copper Producers' Association for January

Marked increases in both domestic and foreign deliveries (the latter being the heaviest for any month on record) together with a decrease in production during January caused a falling off in the stocks on hand in the United States at the end of that month. The fact that no decided increase in foreign consumption has been noticed throws an interesting side light on the statistics, as given below:

	January, pounds	December, pounds
Stocks on hand in the United States on first of month	91,438,867	47,929,429
Production	131,770,274	138,990,421
	223,209,141	186,919,850
Domestic deliveries	47,956,955	21,938,570
Foreign deliveries	87,955,501	73,542,413
	135,912,456	95,480,983
Stocks on hand at end of month	87,296,685	91,438,867

NEW YORK METAL MARKET PRICES

	Feb. 3 Bid	Feb. 3 Asked	Feb. 9 Bid	Feb. 9 Asked
Copper:				
Standard, spot*	....	14.75	....	14.75
	Selling Prices £ s. d.		Selling Prices £ s. d.	
London, standard, spot*	66 7 6		65 0 0	
Prime Lake	15.00 to 15.25		14.87½ to 15.12½	
Electrolytic	14.75 to 14.85		14.65 to 14.75	
Casting	14.55 to 14.65		14.45 to 14.55	
Copper wire base	15.87½ to 16.00		15.87½ to 16.00	
Lead	4.15		4.15	
Nickel	40.00 to 45.00		40.00 to 45.00	
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.50 to		5.45 to 5.47½	
Tin, spot	40.25 to 40.50		40.12½ to 40.50	
Aluminum:				
Prompt delivery	18.75 to 19.00		18.75 to 19.00	
Future	18.60 to 18.75		18.50 to 18.75	

*OLD METALS

Heavy copper and wire	13.75	13.75
Brass, heavy	8.87½	8.87½
Brass, light	7.87½	7.87½
Lead, heavy	4.25	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Feb. 9 7,469

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Indiana Utility Planning Bond Issue.—The $200,000 of 5 per cent first mortgage refunding gold bonds of the Richmond (Ind.) Light, Heat & Power Company fell due on Jan. 1, 1914, and on March 15 the $500,000 three-year 6 per cent debenture notes of the company will fall due. In order to take care of these maturing issues permission has been granted to the company by the Indiana Public Service Commission to issue $850,000 first mortgage bonds, to be sold at not less than 90. In addition to providing for the retiring of the previous issues, the proceeds from the sale of these bonds will be used to pay for extensions and improvements to the company's properties.

Change in Federal Light & Traction Officials.—At the annual meeting on Feb. 4 the following officers were elected by the stockholders of the Federal Light & Traction Company, of 60 Broadway, New York: E. N. Sanderson, president; Francis Blossom and Craig Colgate, vice-presidents; C. C. Chappell, vice-president and general manager, and H. H. Porter, secretary. The entire board of directors was re-elected with the addition of Francis Blossom in place of Parmely W. Herrick, resigned. The financial returns for 1913 were somewhat poorer than those for the preceding year, owing in large measure to the unfortunate fire at Hot Springs, Ark., last summer. Gross earnings came to $2,329,164 for the year ended Dec. 31, and net earnings amounted to $903,492, excluding the statement of the Deming (N. M.) Ice & Electric Company.

Sale of Utah Power & Light Bonds.—The Utah Power & Light Company has sold recently $10,000,000 of first mortgage 5 per cent thirty-year bonds, part of an authorized issue of $100,000,000. The bonds are dated Feb. 2, 1914, and are callable at 105 on or after Feb. 1, 1919. Proceeds of the sale of these bonds are to be applied to the retiring of a portion of the $22,000,000 issue of 6 per cent ten-year bonds of the Utah Securities Corporation now outstanding. The Utah Power & Light Company supplies electrical energy for lighting and power uses in the section centering around Salt Lake City and Ogden, Utah, and including a portion of Idaho. Through its subsidiary, the Western Colorado Power Company, the Utah company covers a part of the State of Colorado. In the Dec. 13, 1913, issue of the *Electrical World* there appeared a note on the status of the Utah Power & Light Company, abstracting a statement of S. Z. Mitchell, president of the Utah Securities Corporation, which is the holding company. A good idea of the extent of the company's properties was given in that note.

Kings County Electric Light & Power Company's Annual Report.—The Kings County Electric Light & Power Company's report for the year ended Dec. 31, 1913, made public this week, shows that the year just past has been one of increased activity and has been attended by satisfactory financial results. The gross earnings during that period amounted to $5,742,548, while net earnings of $2,079,920 and a surplus of $160,699 were realized. On July 1, 1912, the retail rate for energy was reduced from 12 cents per kw-hr. to a sliding-scale demand rate, beginning at 11 cents per kw-hr., and continuing at 8 cents and 4 cents for increased hours of use. Tungsten-lamp prices were greatly reduced, and sizes of 100 watts and over are supplied free to all retail customers. In 1913 a special effort was made to increase the business and more than 100 private plants, ranging in capacity up to 1000 hp, have been replaced by the service of the company. During the year 23,855 contracts were signed. In addition to the current supplied for lighting, 74,052 hp in motors is operated from the company's lines. On March 1, 1913, $2,500,000 of 6 per cent twelve-year convertible debenture bonds were offered to the stockholders at par, in proportion to their stock holdings, and were fully subscribed. On the same date the first issue of $4,000,000 similar debenture bonds became convertible into stock of the company at par, and up to the end of the year $2,942,900 of these bonds were converted. The plant and property of the company have substantially increased, the additions including a new boiler house, substation and station apparatus. The profit-sharing plan inaugurated in December, 1910, was continued, and on Jan. 1, 1914, $56,653 was distributed to 927 employees. The Brooklyn Edison investment fund, designed for the purpose of enabling employees to invest their savings in the securities of the company, achieved a wider usefulness, two-thirds of all employees being depositors in the fund. Three men who had served the company for over twenty years and who, owing to age and physical disability, were unable to perform further duty were pensioned. The company also reports a growing cordiality in relationship between its customers and its employees and notes that, despite the high cost of living and increase in cost of labor, materials and commodities generally, the adoption of substantial economies and increased efficiency have made possible continued first-class service at low rates with a continuance of the high standard of wages to employees. Indications are that the current year will compare favorably with 1913.

Bonds of United Light & Railways Company.—Chicago bankers and brokers are offering for sale the first and refunding mortgage 5 per cent gold bonds of the United Light & Railways Company, of Grand Rapids, Mich., and Chicago. The company owns all or a large majority of the outstanding capital stock of thirteen public service companies operating in Grand Rapids, Muskegon and Cadillac, Mich; Chattanooga, Tenn.; Laporte, Ind.; Rock Island and Moline, Ill., and Cedar Rapids, Marion, Fort Dodge, Ottumwa, Davenport, Muscatine, Iowa City, Clinton and Mason City, Iowa. The 5 per cent bonds of the holding company, now offered for sale, are secured by a first mortgage on the properties of some of the subsidiary companies and by deposit with the trustee under the mortgage of outstanding stock or bonds of other of the companies. Mr. Frank T. Hulswit, the president of the company, in a letter dated Dec. 29, 1913, says that he believes that these bonds are thoroughly well secured. The brokers are offering them for sale at 86 and accrued interest, at which price they net 6.25 per cent. An extra dividend of 1 per cent in common stock was declared recently on the common stock of the company, putting it on a 5 per cent per annum basis. This dividend was explained to be an extra dividend out of surplus and not a quarterly payment.

Union Electric Light & Power Company's Annual Report.—Vice-president A. C. Einstein of the Union Electric Light & Power Company of Missouri, at the annual meeting of the stockholders on Jan. 29, presented the company's annual report, from which the following data are abstracted: Although the energy sold to residence and commercial customers during 1913 exceeded that in 1912 by 17.5 per cent, the gross revenue increased only 0.8 per cent, owing to the general rate reduction made in December, 1912. The financial operations of the company for the year resulted as follows: Gross revenue, $3,683,107.29; operating expenses, $2,145,-241.32; gross income, $1,537,865.97; interest charges, $855,-106.22; net income, $682,759.75. The following statistics were quoted in comparing the business of 1913 with that of 1911 and 1912: The average rate per kilowatt-hour for lighting purposes decreased 14.8 per cent as compared with 1912, and 23.9 per cent as compared with 1911. The average rate received from motor-service sales decreased 12.9 per cent and 21.7 per cent as compared with 1912 and 1911 respectively. During 1913 the greatest load carried was approximately 76,000 hp. Notwithstanding the fact that approximately one-third of the company's power requirements were supplied by the Keokuk station, almost 298,000 tons of coal were used at the Ashley Street station, St. Louis, Mo. The total pay roll of the company for 1913, covering an average of 1100 employees, aggregated over $889,000, an average of $2,435 per day. In the extensions and improvements of the system the company expended during 1913 the sum of $1,174,460 for new property and equipment, and in addition thereto $130,000 was expended in replacing obsolete or worn-out property and approximately $138,000 to maintain equipment. In extensions of the distribution system more than 2000 new poles were set, 411 miles of overhead wire were strung, 70 miles of underground conduit were laid and 30 miles of underground cable were installed. Taxes paid the city, state and federal governments in 1913 aggregated $293,500. This is equal to $6.85 per year for each customer served, 4.05 mills per kw-hr. sold for commercial light and power purposes. The following officers and directors were elected for the ensuing year: Breckinridge Jones, Benjamin Schnurmacher, H. Spoehrer, James Campbell, J. D. Mortimer, A. C. Einstein, C. S. Ruffner, H. N. Davis, H. H. Pierce and Julius Walsh.

Business Notes

C. J. Netting Company, Detroit, Mich., dealer in electrical fixtures, has increased its capitalization from $50,000 to $100,000.

Taylor & Miller is the name of a partnership formed recently by S. R. Taylor and E. A. Miller for the purpose of dealing in public utility securities. The office of the firm is at 49 Wall Street, New York City.

The American Ever-Ready Company, manufacturer of batteries and flash lamps, has appointed W. Covert Jones district sales manager of its Chicago offices. Mr. Jones was formerly sales manager of the Union Electric Company, Pittsburgh, Pa., about seven and one-half years.

A. Chaurette, who has been with the John D. Templeton Company, electrical contractors, for several years, has engaged in business for himself at 345 Woodward Avenue, Detroit, Mich., under the name of the Al. Chaurette Company. The company will design and manufacture lighting fixtures.

Hugh L. Cooper has opened an office at 101 Park Avenue, New York City, for the practice of hydraulic engineering, including design, construction and management of hydroelectric generating plants. Mr. Cooper is well known for his work on the hydroelectric developments at Keokuk, McCall's Ferry, Pa., and Niagara Falls, Ont.

New Industrial Companies

The Ad Electric System Company, of Dayton, Ohio, has been incorporated with a capital stock of $25,000 by James Stoops, H. M. Requarth and W. M. A. Huffelman.

The Royal Electric Heater Company, of Chicago, Ill., has been chartered with a capital stock of $10,000 by William V. Brothers, David M. Brothers and George A. McCarkle.

The King City Electric & Manufacturing Company, of King City, Mo., has been incorporated with a capital stock of $8,000 by George Ward, George P. Adams and Harry V. Forrest.

The Eleco Company, of Bayonne, N. J., has been incorporated with a capital stock of $2000 to deal in electric supplies. The incorporators are Norman Johnson, Mildred V. Stauffer and Joseph Bartlato, of New York, N. Y.

The Quick Charge Storage Battery Company, of New York, N. Y., has been incorporated by S. O. Sabel, R. Law and L. Reid, of New York, N. Y. The company is capitalized at $500,000 and proposes to manufacture storage batteries, electrical apparatus, etc.

The John L. Rossel Manufacturing Company, of Naugatuck, Conn., has been chartered with a capital stock of $15,000 by John L. Rossel, George W. Braun and Oscar Berg, all of 200 Broadway, New York, N. Y. The company proposes to manufacture lighting fixtures, etc.

The American Metal Moulding Company, of Newark, N. J., has been incorporated by C. A. Rubovitz and G. A. Johnson, of Newark, and C. Hanson, of Irvington. The company is capitalized at $50,000 and proposes to manufacture metal conduits for the conveyance of electric wire, etc.

The Removable Letter Sign Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $250,000 to manufacture and sell electrical advertising and display signs. The incorporators are W. M. Pyle, G. G. Steigler and L. W. E. McCarthy, of Wilmington.

The National Conduit Wiring Machine Company has been chartered under the laws of the State of Delaware with a capital stock of $250,000 for the purpose of manufacturing conduit wiring machines and other machinery. The incorporators are I. Hirshfeld, G. F. Stott and F. V. Stott, of New York, N. Y.

The National Motors & Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture and sell motors, fans, hydraulic appliances, etc. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

Trade Publications

Centrifugal Pumps.—The Yuba Construction Company, of San Francisco, Cal., has issued a catalog describing its make of centrifugal pump adapted specially for irrigation pumping service.

Public Utilitiy Securities.—Some interesting general information on the subject of public utility securities is contained in a pamphlet issued recently by E. W. Clark & Company, of Philadelphia, Pa.

Direct-Current Switchboards.—The General Electric Company recently issued Bulletin No. A4189, devoted to small-plant direct-current three-wire switchboards of 125 volts and 250 volts and 10 kw to 100 kw.

Electric-Lighting Specialties.—The sixteen-page booklet recently issued by the Harter Manufacturing Company, of Chicago, Ill., contains information on that company's product, which includes several new features, among them a special shade-positioning device.

Rubber Specialties.—Rubber disks, pump valves, packing, gaskets, tubing and other rubber specialties made by Jenkins Brothers of New York City, are illustrated and described in a sixteen-page pamphlet recently issued under the title "Mechanical Rubber Goods."

Ice-Making Machinery.—"Motor-Driven Refrigerating and Ice-Making Machinery" (Section 3133), a pamphlet issued by the Westinghouse Electric & Manufacturing Company, describes the process employed in this class of work and illustrates the application of electric motors thereto.

Waterwheels.—An exhaustive and well-illustrated catalog, recently published by the Pelton Water Wheel Company, of San Francisco, Cal., covers the field of turbine and tangential waterwheels interestingly and thoroughly. Some attention is paid to the questions of pipe lines, penstocks and governors, and the electrically driven turbine-pump is touched upon also.

Fans.—The General Electric Company is distributing its 1914 illustrated catalog of electric fans, known as Bulletin A-4197. While technical data have been intentionally omitted, the catalog contains sufficient information to enable customers to order intelligently. The publication is devoted to fans for table, wall and ceiling mounting and describes also small ventilating outfits. Among the first-mentioned are fans which are moisture-proof and have fittings which are non-corrodible, especially for use on shipboard.

Air Washers.—The Carrier Air Conditioning Company of America, 39 Cortlandt Street, New York, has issued Catalog No. 13, which contains a comprehensive illustrated description of three types of machines for air washing, cooling and controlling humidity in public or semi-public places. The catalog is interesting not alone for its contents but as reflecting the modern trend toward the purification of the air and the elimination of dust in public buildings, and the possibilities of its becoming of equal importance with the heating problem. Several humidity tables are given, as well as a very useful and interesting chapter on humidity by Messrs. Willis H. Carrier and J. I. Lyle and a section devoted to the physical laws of humidifying and cooling. The apparatus used in the various processes is electrically driven.

Heating.—"Heating and Ventilating a Large Factory" and "Heat Transmission Through Building Walls of Corrugated Iron" are the titles of two articles which the Green Fuel Economizer Company, Matteawan, N. Y., has had reprinted from the *Iron Age* and *Engineering News* respectively for gratuitous distribution. The first describes a hot-blast heating and ventilating outfit, utilizing exhaust steam, installed by the Green company in two large concrete and glass buildings, aggregating 2,400,000 cu. ft., of the Lee Tire & Rubber Company, Coshohocken, Pa. Full particulars of calculations are given. The second article describes tests made on the hot-blast heating equipment of the Green company's own fan shop, which is a steel-frame building covered with corrugated iron. The actual heat transmission found is compared with figures deduced from various data and formulas as given by Rietschel, Grashof, Woodbridge and others, with which it is found in substantial agreement.

Personal Mention

Mr. R. A. Lyons, for many years chief engineer of the London (Ont.) Electric Company, has resigned.

Mr. P. Wilkie has been appointed chief engineer of the London (Ont.) Electric Company, vice Mr. R. A. Lyons, resigned.

Mr. Kent Graham has been appointed manager of the new-business department of the Fremont (Neb.) Gas, Electric Light & Power Company.

Mr. Arthur Reid, formerly superintendent of electric railways and electricity in Lethbridge (Alta.), has been elected commissioner of public utilities for that city.

Mr. Page L. Nourse, local manager of the Southern Sierras Power Company at Elsinore, Cal., has been transferred to the main offices of the company at Riverside, Cal.

Mr. C. J. Johnson, who has been for ten years actively connected with the Capital Light & Power Company of Jackson, Miss., has been appointed general manager of the company.

Mr. B. D. Christian, formerly engineer with the sales department of the Merchants' Heat & Light Company, Indanapolis, Ind., has joined the Chicago sales staff of the Crocker-Wheeler Company.

Mr. James de Young, who recently resigned as superintendent of the Consumers' Power Company in Owosso, Mich., has announced his candidacy for the nomination of Mayor under the new commission charter.

Mr. George E. Quinan, operating superintendent of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been made superintendent of light and power, as successor to Mr. W. J. Grambs, who has been promoted to the position of assistant to the president.

Mr. G. H. Stevens has resigned from the Toronto (Ont.) Railway Company to accept a position with the Canadian Niagara Power Company. Mr. Stevens will have charge of the entire secondary distribution system in the districts of Fort Erie, Bridgeburg and Ridgeway. His headquarters will be at Fort Erie, Ont.

Mr. Victor E. Thelin, formerly testing engineer for the Chicago City Railway Company, has been appointed engineer in charge of the testing department of the Chicago Surface Lines. He did his scholastic work in electrical engineering at Lewis Institute. He will have charge of miscellaneous testing, substation metering and power statistics.

Mr. Joseph H. Brewer, vice-president and general manager of the American Public Utilities Company of Grand Rapids, Mich., was unanimously elected chairman of the board of directors at a meeting held on Feb. 4, as successor to Mr. Charles B. Kelsey, who stepped down from that position on account of his many other duties in public life. Mr. Kelsey continues, however, to retain his financial interests and will take an active part in the affairs of the company.

Mr. H. Almert, for the past five years manager of the department of examinations and reports for Messrs H. M. Byllesby & Company, of Chicago, has opened offices in The Rookery, Chicago, as a consulting engineer. Mr. Almert is completing his twentieth year of active work in the organization, financing, designing, constructing, operating and managing of public utilities, and for several years has valued or passed on investments for new projects, consolidations, reorganizations, etc. He has practised before many of the public service commissions, has served as arbitrator in several condemnation proceedings, and possesses legal training with accounting, backed by technical training and experience. Mr. Almert will have associated with him a staff of assistants in gas, electrical, mechanical and hydraulic engineering.

Mr. A. A. Thurlby, until recently superintendent of wires and cables of the Chicago City Railway Company, has been appointed superintendent of lines and transmission for the Chicago Surface Lines. Mr. Thurlby, who was born in Nottingham, England, in 1860, has had an interesting career. He came to America in 1868 and began active electrical work in 1877 with the Brush Electric Company, of Cleveland, with its erecting force. In this pioneer work Mr. Thurlby traveled extensively at home and abroad. In 1891 he resigned to become manager of the Battle Creek Street Railway Company, where he remained for one year, leaving to become engineer in the inside-wiring department of the Chicago Edison Company. In 1893 he returned to the Brush Electric Company, where he remained but a short time, having accepted a position with the People's Light, Power & Motor Company, of Chicago, as assistant superintendent in charge of overhead lines. He remained with that company when it was absorbed by the Commonwealth Electric Company, resigning in 1899 to be appointed manager of the Manistee (Mich.) Electric Railway Company. In 1902 he became associated with the late John R. Walsh in his electrical projects. He retained this connection until 1907, when he returned to Chicago. In that year Mr. Thurlby was appointed superintendent of underground and overhead wires and cables of the Chicago City Railway Company, which position he held until his present appointment.

Mr. W. J. Grambs, superintendent of light and power of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been promoted to the position of assistant to President Jacob Furth. Mr. Grambs engaged in the electrical business in Seattle in the spring of 1888 and established and organized the Northwest Electric Supply & Construction Company. This company installed the first incandescent electric lighting plant in the Northwest, and successively represented the Edison United Manufacturing Company, the Sprague Electric Railway & Motor Company, the Edison General Electric Company, the General Electric Company and the Northwest General Electric Company. In 1899 Mr. Grambs resigned his position with the General Electric Company to accept the position of purchasing agent of the Seattle Electric Company. In 1905 he was appointed contract agent of that company and two years later sales manager. In November, 1911, he was appointed superintendent of light and power. Between the years 1896 and 1899 Mr. Grambs acted as receiver for several of the street-railway lighting properties in the city of Seattle.

WILLIAM J. GRAMBS

Obituary

Walter Ambrose Pearson, consulting electrical engineer and brother of Dr. F. S. Pearson, died in New York City on Jan. 25. He was born in Putnam, Conn., in July, 1869, and was educated at Tufts College, Mass., and was graduated with the degree of B. A. in the class of 1890. Immediately upon his graduation he entered the employ of the West End Street Railway Company, of Boston, which was then going through the early stages of electric railway development. Mr. Pearson was employed first as a station operator. In 1893 he went to Brooklyn, N. Y., as electrical engineer in charge of the electric installation of the then Brooklyn Heights Railroad Company. In 1896 he became electrical engineer for the Metropolitan Street Railway Company, of New York City, and was particularly active in the development of the Lenox Avenue underground electric system, which was the first underground electric system to be developed in this country. Mr. Pearson remained with the Metropolitan Street Railway Company until 1906. He then went to Niagara Falls for the Electric Development Company of Ontario, in charge of the electrical installation and construction of this company's power house at Niagara Falls. In 1910 he went to Rio de Janeiro, Brazil, and there remained for two years as assistant general manager of the Rio de Janeiro Tramway, Light & Power Company. He returned to the United States in 1912, owing to poor health in the tropics, and became associated with the banking house of Bertron, Griscom & Company, with which he was connected at the time of his death, as consulting electrical engineer. Mr. Pearson was a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the New York Railroad Club and the Engineers' Club of New York.

Construction

New England

MALDEN, MASS.—Surveys are being made by the Malden & Melrose Gas Lt. Co. and the Malden El. Co. of the marsh land in the Wellington section of Medford with a view to removing the plants to that locality.

NEWPORT, R. I.—Steps have been taken by the committee on street lights for the installation of ornamental street lamps on Thames Street.

PROVIDENCE, R. I.—The stockholders of the Narragansett El. Lt. Co., of Providence, have authorized an increase in capital stock from $6,000,000 to $7,500,000.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by Col. Franklin W. Ward, secretary State Board of Armory Commissioners, 174 State Street, Albany, N. Y., until Feb. 16, for construction of heating, plumbing and electric work for armory and stable at Albany for Troop "B," First Cavalry, National Guard, New York. Bids will be received for each division of the work and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of Lewis Pilcher, state architect, Capitol, Albany.

BUSTI, N. Y.—The Public Service Commission has granted the Western New York El. Co. authority to build an extension to its electric lines in this town. Post office address is Busti. R. F. D. Jamestown.

JAMESTOWN, N. Y.—The Public Service Commission has granted the Jamestown Ltg. & Pwr. Co. permission to extend its transmission lines in the town of Busti.

JAMESTOWN, N. Y.—Bids will be received by the board of electric light commissioners until Feb. 26 for furnishing labor and material for the installation of one return tubular boiler, two iron smokestacks and two underfeed stokers with forced-draft equipment, or other stokers, in accordance with plans and specifications on file in the office of the board. Copies of proposal blank, specifications, etc., may be obtained upon deposit of $10, which will be refunded upon return of plans.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, United States Army, Army Building, New York, N. Y., until Feb. 16, for furnishing under Schedule 504 the following supplies: 150 pendent covers, 160 bracket fixtures, 48 keyless sockets, 120 holophane reflectors, 32 key sockets, 14 annunciators, 28 switchboxes, 600 outlet boxes, 14 panelboard boxes, 7 switch boxes, 14 panelboards, 2 panelboards, 1484 galvanized-iron bushings, 9940 ft. galvanized-iron conduit, 525 outlet-box covers, 105 switch-box covers, 42 galvanized-iron covers, 49 galvanized-iron elbows, 56 ceiling fixtures, 28 ceiling fixtures, 14 electroliers, 56 electroliers, 14 electroliers, 84 bracket fixtures, 28 bracket fixtures, 290 mica joints, 1624 lock nuts, 24 watt-hour meters, 28 receptacles, 16 gross brass screws, 6 gross machine screws, 56 holophane shades, 460 gas shades, 140 Hubbell shades, 18 dome shades, 290 fixture studs, 125 push-button switches, 95 switch plates, 175 porcelain key sockets, 15 treads, 35 lb. friction tape, and 12,200 ft. wire, etc. For further information address Lt. Col. M. Gray Zalinski, depot quartermaster.

NIAGARA FALLS, N. Y.—The report of City Electrician Donahue submitted to the Board of Public Works estimates the cost of extending the ornamental street-lighting at $29,700, including all station equipment.

WARSAW, N. Y.—Bids will be received by E. E. Charles, secretary, Warsaw, N. Y., until Feb. 24 for the construction of a high school building as follows: (1) general construction, including reinforced-concrete work, mason work and carpenter work; (2) heating and ventilating; (3) plumbing and gas-piping work; (4) electric wiring. Plans are on file in the office of the secretary of board and the office of Pierce & Bickford, architects, Elmira, N. Y.

FORD CITY, PA.—Within the next six months the managers of the municipal electric-light plant expect to erect a new power house and to install two 300-kw turbine-driven units; also to purchase two 200-hp boilers, two 300-kw, three-phase, 60-cycle, alternating-current generators, two 200-hp turbines, a three-panel switchboard, complete with street-lamp regulator for two circuits (100 250-watt tungsten lamps to each circuit), fifty 40-ft. poles (8-in. top), 20,000 ft. No. 4 weatherproof wire, 500 six-pin fir cross-arms. W. H. Ellis is superintendent and chief electrician.

NEW WILMINGTON, PA.—Improvements are contemplated to the municipal electric-light plant, including the installation of a 75-hp gas engine, a 70-hp steam engine, an 80-hp boiler, generator, ash-handling machinery, lightning arresters, wire, meters, poles, incandescent lamps, etc. J. B. Anderson is engineer.

SCRANTON, PA.—Within the next six months the United Service Co., of Scranton, expects to install coal-handling apparatus at three plants; also to install one 1250-kva turbine-driven unit and to remodel the distribution system in Warren, Pa.

WILKES-BARRE, PA.—Within the next three months the Wilkes-Barre Co. expects to erect one coal-conveying line and coal-storage bins over top of boilers; also to purchase one 600-hp water-tube boiler and 3 miles of 0000 wire for transmission line from station No. 1 to station No. 2. E. A. Wakeman is manager.

MILFORD, N. J.—The town of Milford, it is reported, is contemplating the purchase of the electric-light plant of the Keystone Broom Co., to be owned and operated by the municipality.

PHILLIPSBURG, N. J.—The Board of Public Utility Commissioners has issued an order that the Phillipsburg Lt., Ht. & Pwr. Co. should be entitled to a franchise to operate in Phillipsburg. Application of approval of an issue of $125,000 in capital stock by the company was deferred until after an ordinance should be approved granting the company permission to do business in Phillipsburg.

SPRING LAKE, N. J.—The Borough Council has engaged P. H. Ogden, of Newark, civil engineer, to make investigations and prepare estimates of the cost of installation of a municipal electric-light plant. Edward White, superintendent, has been instructed to advertise for bids for the proposed cluster-lamp lighting system on the beach front, the bids to include wiring, conduits, standards, lamps, etc.

EASTON, MD.—A bill has been introduced to the State Legislature asking that the City Council be given authority to issue $30,000 in bonds to establish a municipal electric-light plant in Easton.

HAGERSTOWN, MD.—In a decision handed down by Judge Robert R. Henderson the injunction suit filed by the Mayor and Council is dissolved and the Hagerstown & Frederick El. Ry. Co. is given legal right to sell electricity for lamps and motors in Hagerstown in competition with the municipal electric-light plant. The questions in dispute have been pending since the municipal plant was established 15 years ago.

RISING SUN, MD.—The town of Rising Sun has petitioned the State Legislature for authority to issue bonds for the installation of an electric-light plant.

HARRISONBURG, VA.—J. M. Snell, chairman of the electric-light committee, has recommended to the Town Council the installation of an auxiliary plant, to cost about $12,000. It is proposed to install a large generator to be directly connected with one of the present turbine wheels or to a new wheel.

VICTORIA, VA.—A franchise for an electric-light system and also for telephones is being advertised by the town of Victoria. For further details address H. T. Faison, town clerk.

WASHINGTON, D. C.—All bids received Jan. 9 at the Department of the Interior, Washington, D. C., for remodeling the power plant of the Government Hospital for the Insane at Washington, D. C., have been rejected and the work readvertised.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Feb. 24 for furnishing 11 miles of paper-insulated, submarine, armored type No. 324 cable, in accordance with Specifications 96-C and drawing 106 therewith, to be furnished in 1-mile lengths, under Proposal No. 689.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 3 for furnishing at navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6390—15 portable electric drills (125 volts, two speeds); Schedule 6383—20 telegraph hand keys for radio transformers; Schedule 6382—two motor-driven wood lathes. Portsmouth, N. H., Schedule 6367—four electric sterilizers, copper nickel-plated, with tray. Brooklyn, N. Y., Schedule 6371—one 72-cell storage battery, complete, 20 gal. electrolyte; Schedule 6386—14,500 ft. rubber-covered, duplex lighting and power wire. Camden, N. J., and Quincy, Mass., Schedule 6371—four ringing dynamometers and two telephone motor generators, 30 miscellaneous telephone jacks, miscellaneous telephones and two telephone switchboards. Bids will also be received until March 10 as follows: Annapolis, Md., Schedule 6361—one electric dynamometer, with controlling panel and leading rheostats, one portable superheater, f.o.b. works, etc.; Schedule 6303—miscellaneous trolley track, with brackets and hangers; Schedule 6305—650 lb. 11/64-in. diameter aluminum wire. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, U. S. A.

WASHINGTON, D. C.—L. B. Stillwell, consulting electrical engineer, 100 Broadway, New York, N. Y., has been engaged by Byron R. Newton, Assistant Secretary of the Treasury, to co-operate with the engineering force of the office of the supervising architect, Treasury Department, to prepare preliminary plans for a central plant to furnish light, heat and power to government buildings, for which Congress has appropriated $1,494,104 for buildings, equipment, machinery, etc., complete. The proposed plant will be located on the river front at Water Street, between Thirteenth and Thirteen and One-half Streets, and will provide heat, light and power to government buildings, old and new, west of the Peace Monument, including the Bureau of Engraving and Printing, the buildings of the Department of Agriculture, the Treasury building, the White House and buildings on the White House grounds, the State, War and Navy Building, the Winder and the Mills buildings, the Court of Claims building, the National Museum, the Smithsonian Institution, the Army Medical Museum, the Fish Commission, the Washington Monument, the District building and the Post Office Department, and the buildings when constructed on the sites acquired for each of the Departments of State, Justice and Commerce and Labor. The law contemplates a cross-connection between this central plant and the Capitol power plants; so that either plant may supply energy to the other in case of breakdown or other emergency.

North Central

DETROIT, MICH.—Bids will be received by Charles A. Gadd, secretary of school board, until March 10 for electric wiring in the Northeastern High School building, to be erected at Hancock and Warren Streets.

DETROIT, MICH.—The Mack Printing Co., of Detroit, is contemplating the erection of a power plant in connection with its new printing establishment at Elizabeth and John Streets, now in course of construction.

ESCANABA, MICH.—The Escanaba Trac. Co., it is reported, contemplates the construction of a new power dam on the Escanaba River at or near Chandler's Falls, 2 miles from the city limits at Gladstone. The company has applied to the State Railroad Commission for authority to issue $225,000 in bonds.

GRAND RAPIDS, MICH.—Owing to the engineering plans not being completed in time, the date for receiving bids for construction of South High School building has been extended from Feb. 16 to Feb. 23. Henry E. Crow is president of board of education.

IRONTON, MICH.—We are informed that the village of Ironton does not contemplate the installation of a municipal electric-light plant as reported in the issue of Jan. 10. Joseph W. Flanders is village clerk.

ARCANUM, OHIO.—The Board of Public Affairs expects to purchase within the next 12 months electrical supplies, consisting of lamps, general inside wiring material, line supplies and meters, amounting to from $600 to $800. C. C. McCool is superintendent.

BELLEFONTAINE, OHIO.—Bids will be received at the office of the Board of Control, Bellefontaine, until Feb. 21 for new equipment for the municipal electric-light plant. It is understood that the output of the plant will be doubled.

COLUMBUS, OHIO.—Proposals will be received by Samuel A. Kinnear, director of public service, Columbus, Ohio, until Feb. 24 for furnishing and installing an electric motor for the East Side sewage pumping station, in accordance with plans and specifications in the custody of the superintendent of water-works, City Hall, Columbus, from whom copies may be obtained.

GALLIPOLIS, OHIO.—The local electric-light plant is reported to have been sold recently at a sheriff's sale to J. F. Tanner for $6,585. A new company, it is said, will be organized to operate the plant.

MANSFIELD, OHIO.—The Mansfield Ry., Lt. & Pwr. Co. expects to erect within the next eight months a new office building, 31 ft. by 90 ft., two stories high (brick and concrete). S. A. Foltz is secretary and manager.

SHILOH, OHIO.—The Village Council has passed an ordinance authorizing the purchase of the local electric-light system and equipment, together with the high-tension transmission line connecting Plymouth and Shiloh and contract for furnishing energy, from N. J. McBride, for $4,827.

HAZARD, KY.—The Hazard Lt. & Pwr. Co., it is reported, contemplates an expenditure of $10,000 for equipment for its plant. The company recently increased its capital stock from $15,000 to $30,000.

LOUISVILLE, KY.—Plans are being considered by the Swiss Cleaners & Dyers, of Louisville, for the construction of a plant, to cost about $50,000, which will be equipped for electrical operation. The company will install an electric plant, for which boilers and engine have been purchased. It is understood that orders have not yet been placed for a 60-kw generator and four motors ranging from 5 hp to 35 hp. Dr. H. E. Mechling is manager.

ATLANTA, ILL.—The Atlanta El. Lt. & Pwr. Co. expects to erect within the next three months 4 miles of transmission lines; also to purchase one car load of poles, 400 insulators and 12 lightning arresters (6600 volts); also within the next six months to purchase a 200-hp boiler. J. C. Robinson is manager.

MALTA, ILL.—A committee has been appointed to make investigations relative to the installation of an electric-light system in Malta.

SHELDON, ILL.—The installation of a municipal electric-light plant in Sheldon is reported to be under consideration.

DEERFIELD, WIS.—A company is reported to have been organized with a capital stock of $500,000 to furnish electricity in Deerfield and vicinity. Among the incorporators are O. A. Oestrich, L. A. Avery and Leora Westlake, all of Janesville.

LOWELL, WIS.—The Board of Village Trustees has granted the Lowell El. Lt. & Pwr. Co. a franchise to furnish electricity for lamps and motors in Lowell.

SHEBOYGAN FALLS, WIS.—Bonds to the amount of $49,000, it is reported, have been issued for the construction of an electric light and power plant and waterworks system.

AURORA, MINN.—The report submitted by Emile B. Jackson, consulting engineer, of St. Paul, to the Village Council relative to the installation of a municipal electric-light plant, estimates the cost of a new plant at $25,000 and the cost of generating electricity at 3.45 cents to 3.88 cents per kw-hr. The cost of energy purchased from the Range Pwr. Co. would be about the same, and the cost of development of the water-power south of the town is estimated at $70,000. The Council has decided to install a steam plant at a site where trackage can be secured.

BELLINGHAM, MINN.—The installation of an electric-light system in Bellingham is under consideration. Electricity for operating the system may be secured from the plant in Madison.

BLUE EARTH, MINN.—Within the next few days the Board of Public Works expects to purchase underground conduit, distribution cable and wire for the municipal distribution system; also to purchase within the next 30 days 28 lamp-posts for five-lamp clusters, 24 lamp-posts carrying one lamp 8000 ft. underground cable and conduits for same. A motor-driven pump for deep well will also be installed. D. Fitch is superintendent.

EXCELSIOR, MINN.—Bids will be received by Harry E. Wistrand, village recorder, Excelsior, Minn., until Feb. 25 for the construction of a water-works system as follows: Division No. 1, distribution pipe line and accessories; division (2) furnishing and erecting a 75,000-gal. hemispherical tank on a 90-ft. steel tower; (2A) consisting of a 75,000-gal. elliptical steel tank on a 90-ft. steel tower; (3) for furnishing and installing complete with all accessories a 200-gal. triplex power pump directly connected to a 20-hp, three-phase, 220-volt motor; (4) construction of pumping station complete. Plans and specifications are on file at the office of village recorder, Excelsior, and at the office of J. F. Druar, of the Oscar Claussen Engineering Co., Commercial Building, St. Paul, Minn.

LISMORE, MINN.—Plans, it is reported, have been prepared by Earle D. J. Jackson, consulting engineer, Capital Bank Building, St. Paul, for an electric-light plant in Lismore. Through error this item appeared under Lismore, Mich., in the issue of Jan. 31.

LUVERNE, MINN.—Bids will be received by the City Council until Feb. 24 for the installation of an ornamental street-lighting system on Main Street, from Estey Street to Spring Street, in accordance with plans and specifications on file in the office of the city recorder. Plans and specifications may be seen and blank forms of proposal obtained at the office of L. P. Wolff, consulting engineer, St. Paul, Minn. S. C. Rea is city recorder.

WARREN, MINN.—Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul, is reported to have been engaged to prepare plans and estimates for the proposed improvements to the municipal electric-light plant and water-works system.

ESTHERVILLE, IA.—The City Council has engaged W. H. Grover, consulting engineer, of Ames, Ia., to make investigations and prepare plans and estimates for the entire reconstruction of the municipal electric-light plant.

LAKE VIEW, IA.—At an election held recently the citizens voted to secure electricity from the electric plant at Sac City.

MUSCATINE, IA.—It is reported that plans are being considered by the Muscatine North & South Ry. Co. for equipping its railway from Muscatine to Burlington for electrical operation. The Muscatine Ltg. Co. is reported to have offered to furnish energy to operate the railway and has prepared an estimate of the cost of same. The proposal to operate the railway with electricity is made jointly with the proposition to furnish electricity to operate the No. 3 drainage district pumping station, 25 miles below the city.

MUSCATINE, IA.—The City Council, it is reported, will engage an engineer to make investigations and submit a report on the cost of a lighting system or a municipal electric-light plant.

RIDGEWAY, MO.—The installation of a municipal electric-light plant in Ridgeway is reported to be under consideration.

ST. CHARLES, MO.—We are informed that the St. Charles El. Lt. & Pwr. Co. was recently granted a renewal of its franchise in St. Charles for a period of 20 years. Reported in the issue of Jan. 24 to have been granted a franchise to furnish electricity in St. Charles. W. G. Ghiselin is manager.

SHELDON, N. D.—We are informed that the village of Sheldon does not contemplate the installation of a street-lighting system as reported in the issue of Jan. 31. A. H. Lindemann is village clerk.

SIDNEY, NEB.—The Council, it is reported, has decided to engage an engineer to make surveys and prepare plans for a municipal electric-light and heating plant. J. J. McIntosh is chairman.

STERLING, NEB.—The installation of an electric-light plant in Sterling is reported to be under consideration. Mr. Marks, of Wymore, is said to be interested in the project.

GLEN ELDER, KAN.—The local electric-light plant, owned by A. J. Abrams, is reported to have been purchased by Charles Townsend, who will take charge of the plant at once.

PITTSBURG, KAN.—Petitions have been presented to the city commission asking for the installation of pedestal illumination system on Broadway and adjacent cross streets.

VERMILLION, KAN.—The installation of a municipal electric-light plant in Vermillion is reported to be under consideration.

Southern States

ASHEVILLE, N. C.—The Toxaway Pwr. Co., organized about a year ago with a capital stock of $1,500,000, has been reorganized. The company owns or controls extensive water rights and property in Western North Carolina and proposes to develop water-power rights along the Toxaway River in Transylvania County, the Green River and other streams.

BEAUFORT, N. C.—The Board of Public Works expects to install a 150-hp tubular boiler in the municipal electric-light plant within the next six months; also to purchase one boiler-feed pump, about 100 35-ft. poles, cross-arms, etc. The installation of a meter system throughout the city (consisting of 125 meters, ranging from 5 amp to 100 amp) has just been completed. H. H. Lewis is superintendent.

CONNELLY'S SPRINGS, N. C.—It is reported that preparations are being made by the Connelly's Springs Knitting Mills Co. to build a hydroelectric plant, work to begin in 60 days. The work will include construction of concrete dam, power house and the erection of 4 miles of transmission line, to cost about $6,000. Arrangements have been made for machinery and material. D. B. Mull is manager.

ROWLAND, N. C.—Bids will be received by the commissioners of the town of Rowland, N. C., for the purchase of $30,000 thirty-year 6 per cent coupon bonds until March 10, the proceeds to be used for equipment and maintenance of an electric-light plant, water-works and sewerage system. For further information address O. P. Chitty, clerk of board of commissioners. J. McR. Bracy is Mayor.

BISHOPVILLE, S. C.—Within the next 30 days the managers of the municipal electric-light plant expect to purchase one 60-kw, 60-cycle, 2300-volt General Electric generator with exciter and switchboard for same; also within the next two or three months to purchase equipment for an ornamental street-lighting system. It is planned to rebuild the distribution system, which will require from 50 to 75 poles and other equipment. S. P. Sutton is superintendent.

WALHALLA, S. C.—The Walhalla Lt. & Pwr. Co. (recently incorporated), it is reported, has awarded a contract to Quartermus & McDonald for building of a dam at the shoals at the Rhett tract, about 4 miles from Walhalla. The proposed dam will be about 125 ft. long and 15 ft. high and will furnish power to generate electricity. The cost of the plant complete is estimated at $20,000. W. A. Strother and Dr. J. W. Bell are among the incorporators.

DRESDEN, TENN.—The city of Dresden is reported to have issued $27,000 water and light bonds.

MEMPHIS, TENN.—Bids will be received by the Mississippi River Commission, First and Second Districts, United States engineer's office, Memphis, Tenn., until Feb. 25, for furnishing 787,000 lb. galvanized wire, silicon wire, wire strand and staples and 30,000 wire rope clips. Further information may be obtained upon application to Major E. M. Markham.

OVOCA, TENN.—The trustees of the Widows and Orphans Home of the Knights of Pythias are reported to have authorized H. W. Stratton, superintendent, to install a water-power plant to generate electricity to light the buildings and grounds and operate the laundry, printing plant and other machinery. The work will include laying an 8-in. pipe to carry water from Lake Calanthe to a point below Cascade Falls, where a power house will be erected. The proposed plant will have sufficient output to maintain from 250 to 300 lamps. G. M. Whitson, civil engineer, of Tullahoma, Tenn., will have charge of the work. Post office address, Chattanooga, Tenn.

ARMSTRONG SPRINGS, ARK.—The management of the Armstrong Springs Hotel is contemplating the installation of an isolated electric plant at once and would like to receive catalogs and prices on 10-hp gas engines and 6-kw direct-current dynamos (belted). Tungsten lamps will be used. D. E. Harrison is manager.

NEW ORLEANS, LA.—Plans are being considered by E. E. Lafaye, commissioner of public property, for the installation of an electric-light plant in connection with a garbage disposal plant.

GRANDFIELD, OKLA.—The local electric-light plant, owned by J. A. Brabbam, is reported to have been destroyed by fire recently.

DALLAS, TEX.—The Phoenix Construction Co. is erecting a high-tension transmission line between Fort Worth and Dallas for the Texas Pwr. & Lt. Co., with branch lines from Irving to the large cement plants west of Dallas, and another to McKinney to a connection with the Sherman interurban line. The lines will be carried on steel towers.

FAYETTEVILLE, TEX.—Work, it is understood, will start on the new electric-light plant and creamery.

PECOS, TEX.—The City Council has decided to install ornamental lamps in the business section of the town, also extending the system to a portion of the residence district. Ornamental posts have been ordered, and an appropriation of $750 has been made to cover the first cost.

Pacific States

BELLINGHAM, WASH.—We are informed that the Puget Sound Trac., Lt. & Pwr. Co. does not contemplate any improvements to its power plant, as reported in the issue of Jan. 17.

OMAK, WASH.—The federal authorities at Washington have authorized the immediate installation of an electric power station on the Okanogan River and a large

pumping plant just north of the city, to furnish an auxiliary supply of water for the orchards in the Robinson Flat section of the Okanogan irrigation project. Sufficient funds have been appropriated to complete the work. Calvin Casteel, of Omak, is manager of the project.

SEATTLE, WASH.—The committee on municipal affairs of the Commercial Club has unanimously voted in favor of the City Council increasing the capacity of the municipal lighting system, declaring that the amount of energy generated at the Cedar Falls plant is inadequate. The committee does not recommend or suggest what power site should be secured, although it is understood it favors the Lake Cushman site. The committee also recommends that the auxiliary steam plant be installed at once and that the city acquire sufficient power sites to care for the future needs of the city.

SEATTLE, WASH.—Upon the recommendation of Lighting Superintendent J. D. Ross, the Board of Public Works, on Jan. 27, reconsidered its action in awarding the contract for the equipment of a steam auxiliary lighting plant on the east shore of Lake Union to Charles C. Moore & Co., at $154,500, and made the purchase in two awards as follows: The machinery equipment, with the exception of a turbo-generator and exciter, was awarded to Charles C. Moore & Co., at $98,668, and for a 7500-kw turbo-generator and exciter to the Allis-Chalmers Mfg. Co., of Milwaukee, Wis., at $67,355. The contract for 53 posts for cluster-lamps, to be used in the Fifth Avenue district, has been awarded to the Westerman Iron Works, at $1,643.

CRESWELL, ORE.—The Creswell Lt. & Pwr. Co. expects to purchase within the next three months one waterwheel governor and one bevel mortise gear (1 in. to 11 4-36 in. in diameter). John Tunnell is owner.

HOOD RIVER, ORE.—Plans are now being made for the installation of a cooperative or a municipal hydroelectric power plant to furnish electricity for Hood River Valley. Filings have been made for water rights (capable of developing 2000 hp) along the Hood River. Mark Cameron, of Odell, Ore., is chairman of the committee appointed to carry out the project. J. C. Howland, R. F. D., 147, Hood River, is also a member of the committee.

LEBANON, ORE.—A petition has been presented to the Council asking that an election be called to vote on the proposal to grant a 20-year franchise to Scroggins & Washburn, owners of the lumber mill, to erect and operate an electric-light plant within the city limits.

McMINNVILLE, ORE.—The water and light commission has decided to erect a transmission line to Fairview to furnish electricity for lamps and motors there. The erection of the main line will be paid by this city, but the distribution lines will be erected at the cost of the patrons. The cost of the installation is estimated at $3,800.

PORTLAND, ORE.—The city commission has rejected all bids submitted for the installation of a new lighting system in the city hall and has instructed City Purchasing Agent Wood to readvertise for new bids for the work.

WALLOWA, ORE.—The City Council has engaged L. A. Reinaman, civil engineer, to make surveys and prepare estimates of cost of the installation of a municipal electric-light plant in Wallowa.

CALEXICO, CAL.—Plans are being considered to establish a municipal electric-light plant to furnish electricity for street-lighting in conjunction with the city waterworks system.

COVINA, CAL.—Preparations are being made by the city trustees to light the streets of the city with electroliers.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Co., it is stated, will rebuild its transmission line between Dos Palos and Los Banos as soon as the weather will permit.

GLENDALE, CAL.—The City Council has instructed Harry B. Lynch, manager of the municipal electric-light plant, to secure bids for ornamental electroliers (for five-lamp clusters) to be erected on Brand Boulevard, between First and Third Streets.

HUGHSON, CAL.—Plans, it is reported, are being prepared for the installation of a street-lighting system in Hughson. Miles Shelly is interested in the project.

LODOC, CAL.—The State Railroad Commission has granted E. M. Wilson, Nettie B. Harris and Lawrence A. Wilson permission to operate an electric-light plant in Bieber, Lassen County, and Lodoc, Modoc County.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. has applied for permission to issue $25,000 in bonds, a portion of which will be used for refunding outstanding indebtedness and the balance for extensions and improvements to its system.

PORTOLA, CAL.—R. B. Young, of Loyalton, has applied for a franchise to furnish electricity for lamps and motors in Portola. The franchise will be sold to the highest bidder at the March session of the supervisors.

ST. HELENA, CAL.—Negotiations are under way between the Town Council and vintage festival committee in regard to placing electroliers on Main Street, from bridge to bridge. The cost of the installation is estimated at $2,700, of which the vintage festival committee offers to pay $1,600. H. J. Chinn is president of the Chamber of Commerce and chairman of the vintage festival committee.

SUSANVILLE, CAL.—Arrangements have been made by the Lassen El. Co., of Susanville, for the construction of a new plant, to be situated about ½ mile west of Susanville and to be known as plant No. 2. The equipment will consist of one Leffel turbine, one Woodward governor, one 50-kw, 60-cycle, 2200-volt General Electric generator, single-panel switchboard, three ammeters, one voltmeter, synchronizer, four-point plug switches, each phase connected. The company has disposed of its electrical contracting and supply business to the Electric Supply Co., which will carry stock and do an electrical contracting business. O. S. Paine is engineer in charge of construction of new plant, and L. R. Cady is general manager of the Lassen Co.

VAN NUYS, CAL.—Work has just been started for pulling wire for the ornamental lighting system on South Sherman Way and the State Highway. It is expected the work will be completed sometime in March. The completion of these stretches will close the gap in the 25-mile circuit of paved and lighted highway, encircling the entire western end of the San Fernando Valley.

GRAND CANYON, ARIZ.—Ten of the 40 platinum claims of Ralph H. Cameron in the Grand Canyon of the Colorado River near Bright Angel Trail have been taken by J. Bishop & Co., of Malvern, Pa., platinum manufacturers. The company, it is said, will erect an electric generating plant to furnish power to operate a 100-ton reduction plant to be erected near by.

BUTTE, MONT.—The City Council has awarded the Montana Pwr. Co., of Butte, the contract for the installation of the new ornamental street-lighting system. The contract calls for 306 General Electric 6.6-amp inverted magnetite arc lamps, erected on ornamental posts, maintained with underground wires, to cost $31,125. The work is to be completed by July 1, 1914. M. J. Flood is city engineer. A. von Dalhenhausen is commercial manager of the Montana Pwr. Co.

CORWIN SPRINGS, MONT.—The Electric Hot Springs Co., of Corwin Springs, expects to purchase generating equipment, to duplicate the present plant. James Shine is electrician.

WHITE SULPHUR SPRINGS, MONT.—Municipal improvements to cost approximately $100,000 have been decided upon by the City Council, including the installation of an ornamental street-lighting system, cement sidewalks and sewer system. The Gerharz-Jaqueth Engineering Co., of Billings, has been engaged to take charge of the work.

KREMMLING, COL.—F. I. Huntington is reported to have submitted an estimate on the cost of installing an electric-light and water plant for Kremmling. He states that a steam plant erected on the river near the railroad station (at a cost about $20,000) would furnish electricity for pumping water for town supply and for lighting the streets and residences here.

Canada

CHILLIWACK, B. C.—The City Council has entered into a new contract with the British Columbia El. Ry. Co., Ltd., of Vancouver, for lighting the city for a period of ten years. Under the terms of the new contract an entirely new system will be installed. The present 32-cp lamps will be replaced with 100-cp tungsten lamps.

SHOAL LAKE, MAN.—The town of Shoal Lake, it is reported, is contemplating the installation of a municipal electric-light plant, to cost about $15,000.

BROUGHTON, N. S.—The Broughton Coal & Iron Co. is considering the installation of an electric plant capable of taking care of 2000 tons of coal per day, the central plant to be located at Broughton.

BRANTFORD, ONT.—At a special election held Feb. 2 the by-law authorizing debentures to the amount of $70,000 for extensions to the hydroelectric system was carried. This provides for the distribution of electricity from the Hydro-Electric Power Commission for lamps and domestic use.

CREEMORE, ONT.—It is reported that plans are being prepared for the construction of a hydroelectric power plant in Creemore, to cost about $50,000, for which bids will soon be asked.

HESPELER, ONT.—A by-law has been passed authorizing an expenditure of $12,000 for improvements to the municipal electric-light plant.

NICKELTON, ONT.—The Canadian Nickel Corpn., it is reported, is preparing plans to generate electricity to operate its works at this point. The reduction works of the company, it is understood, will have an initial capacity of 40,000 tons per month.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Ry. Co. is installing a new converter station at St. Catharines, to be equipped with two Canadian General Electric 500-kw rotary converters and necessary accessories, at a cost of about $35,000.

WESTON, ONT.—The electric-light and water-works commission has decided to repair the old steam-driven electric plant on Little Avenue and maintain it as an auxiliary in case of break-down in the hydroelectric service.

LAKE MEGANTIC, QUE.—New tenders, it is reported, will be called in a few weeks for the construction of the dam in connection with the municipal light and power plant.

LONGUEUIL, QUE.—The Armstrong Whitworth Co., of Canada, which is building a large plant in Longueuil on the St. Lawrence River, contemplates equipping its works with electrical operated machinery. Electricity will be supplied by the Montreal Lt., Ht. & Pwr. Co. at 22,500 volts, which will be stepped down to 2200 volts. The equipment will include synchronous-motor connection to a three-wire, 500-volt direct-current generator. There will also be a large motor for the rolling mill.

TERREBONNE, QUE.—The plant of the Terrebonne El. Lt. Co. was damaged by fire recently, causing a loss of about $1,000.

DAVIDSON, SASK.—A by-law authorizing an appropriation of $8,500 for the purchase and installation of an electric-light plant was approved by the ratepayers.

Mexico

MEXICO CITY, MEX.—Applications have been made to the federal government for water-rights concessions to develop electricity as follows: Maria Guadalupe and A. de Garcia for water rights of Rio de la San Jeronimo, State of Jalisco, and José Julian Mendez for water rights on the Rio de San Jeronimo, State of Jalisco.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, Isthmian Canal Commission, Washington, D. C., until Feb. 17 for wire chain, chain bolts, steel smokestack netting, brass tubing, engine lubricators, oil cups, side lamps for launches, glass packing, asbestos gaskets, etc. Blanks and general information relating to this circular (No. 827) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

LANSING, MICH.—The Michigan Lt. Co. has been chartered with a capital stock of $3,000,000 to operate in Bay City, Saginaw, Flint, Pontiac, Jackson, Kalamazoo and Manistee. The incorporators are: William H. Barthold, of New York, N. Y.; Frank A. Newton, C. Wilcox and James A. Brown.

GOWER, MO.—The Gower Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of $10,000 by Curtis Poe, John R. Allen and S. A. Groom.

DUVALL, WASH.—The Duvall Lt. & Pwr. Co. has been incorporated with a capital stock of $16,000 by E. Milton and Stephens B. F. Bird.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 3, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,085,598. OZONE GENERATOR; W. O. Freet, Hackensack, N. J. App. filed May 20, 1912. For producing ozone in small quantities for use in apartments, etc.

1,085,615. TELEPHONE SYSTEM; P. Lavery Webster, and W. E. Bandlow, Dudley, Mass. App. filed Feb. 24, 1913. Listening by a third party is prevented on party lines.

1,085,616. INDUCTIVE OR TRANSFORMER BOND; J. S. Lennox, Pittsfield, Mass. App. filed March 6, 1912. Inclosing casing or shell of magneto material serves as part of the magnetic circuit for the bond.

1,085,621. TELEPHONE SIGNALING FOR RAILWAYS; M. Lutenberger, Blocton, Ala. App. filed Aug. 28, 1913. Telephone hood within which the trainman places his head to exclude external noise.

1,085,637. GALVANOMETER; R. R. Shay and M. C. Stoelting, Chicago, Ill. App. filed Sept. 9, 1912. Embodies a suspended coil.

1,085,707. ELECTRIC STORAGE-BATTERY NEGATIVE-POLE PLATE; E. W. Smith, Philadelphia, Pa. App. filed May 19, 1905. Grid with a mask of non-fibrous powdered inert material capable of expanding ordinary oxides of lead.

1,085,718. APPARATUS FOR PREPARING BLEACHING AND LIKE FLUIDS; C. A. M. Buckley, London, Eng. App. filed Aug. 13, 1913. Electrolytic apparatus in which an improved circulation of the fluid is secured.

1,058,726. RAILWAY SIGNAL; J. P. Coleman, Edgewood Borough, Pa. App. filed April 14, 1913. Inductive holding device for holding a signal in one position against its normal bias.

1,058,742. HOOD FOR ELECTROPLATING TANKS; C. E. Leffel, Niagara Falls, N. Y. App. filed April 16, 1913. For conducting away the fumes, gases and vapors arising from the electrolyte.

1,058,743. ANODE SUPPORT; C. E. Leffel, Niagara Falls, N. Y. App. filed April 25, 1913. Supporting hook about which the anode plate is cast which can be unscrewed from the plate when the latter is worn out.

1,058,744. ELECTROPLATING RACK; C. E. and J. D. Leffel, Niagara Falls, N. Y. App. filed May 7, 1913. Rack carrying wire supports for the articles to be plated.

1,085,769. SPOT-WELDING THIN SHEETS; E. Thomson, Swampscott, Mass. App. filed May 10, 1913. Clamps thin sheets together and then applies pointed electrode at an unclamped part of the plates.

1,085,802. ELECTRICAL AGRICULTURAL SYSTEM; C. S. Doney, Wallace, Idaho. App. filed Feb. 13, 1913. For supplying electrical power to agricultural tractors or motor vehicles.

1,085,807. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed May 23, 1911. Single-phase self-excited series induction motor whose speed, starting torque, torque curve and power factor can be easily adjusted.

1,085,808. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed June 12, 1911. Conveys current conductively to the commuted winding along the axis of the main inducing winding.

1,085,813. INSULATOR AND CURRENT DISTRIBUTER; E. H. Knutz, Arcata, Cal. App. filed March 6, 1913. Carries breakable insulators which may be broken out to enable the wire to be electrically connected with the arm.

1,085,826. INDICATING PUSH-BUTTON; W. R. Schlage, San Francisco, Cal. App. filed March 5, 1913. Indicator applied to push-button to give notice that the occupant is "out."

1,085,829. TROLLEY-WIRE EAR; W. C. Starkey, Zionsville, Ind. App. filed Aug. 12, 1909. Made of "extruded" metal so as to be stronger and have higher elastic limit.

1,085,854. CONTROLLER REGULATOR; H. Elbe, Maspeth, N. Y. App. filed May 19, 1911. Has timing element which prevents full voltage being suddenly sent through the motor.

1,085,916. INTERCOMMUNICATING TELEPHONIC APPARATUS; M. R. Hutchinson, Summit, N. J. App. filed May 21, 1909. Head set applied to the cap and arranged to exclude external noise.

1,085,920. ELECTRICAL SWITCH; G. A. Knaak, Oshkosh, Wis. App. filed June 10, 1912. Circuit controller for electric-motor-driven fluid compressors.

1,085,937. AUTOMATIC ELEVATOR PLANT; C. O. Pearson and A. Sundh, Yonkers, N. Y. App. filed Sept. 21, 1908. Push-button system, including an internal-combustion engine started at will and automatically controlled.

1,085,951. ELECTRIC FUSION OF METALS; A. P. Strohmenger, Westminster, London, Eng. App. filed Sept. 25, 1913. Places fusible slag-forming insulating material between two rods of metal which are connected to source of current and collects the fused metal.

1,085,959. TERMINAL FOR SECONDARY OR STORAGE BATTERIES; J. W. Achard, Philadelphia, Pa. App. filed July 19, 1912. Has a plate of higher specific conductivity and embedded in the leader bar which is connected to a group of electrodes.

1,085,960. ELECTRIC CONNECTOR; J. Berg, Chicago, Ill. App. filed Nov. 8, 1912. Embodies a double-ended socket which receives the terminal plugs.

1,085,974. TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Oct. 12, 1908. For enabling a station to call the exchange while connection is still maintained with another station.

1,085,981. BLOCK-SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed July 14, 1908. Embodies a slow-acting mutual relay and a quick-acting polarized relay in circuit with the line wire.

1,085,982. ELECTRICAL SYSTEM OF DISTRIBUTION; H. Hazelton, Englewood, N. J. App. filed Sept. 20, 1909. Storage-battery system for supplying lamps in an electric-railway coach upon failure of the main current supply.

1,085,985. KEYBOARD TAPE PERFORATOR; E. E. Kleinschmidt, New York, N. Y. App. filed March 20, 1912. Punches operated in groups and controlled by selected keys, one for each group.

1,085,987. REVERSAL REGULATOR FOR SINGLE-PHASE MOTORS; D. L. Lindquist, Yonkers, N. Y. App. filed April 26, 1910. For use in connection with repulsion induction motor operating an elevator.

1,086,003. MANUFACTURE OF STEEL; W. R. Walker, New York, N. Y. App. filed May 4, 1911. Deoxidizes in an acid electric furnace.

1,086,028. ELECTRICAL PROTECTIVE DEVICE; F. B. Cook, Chicago, Ill. App. filed May 10, 1911. Improved means for mounting the fuse-holding spring members upon the base plate of the unit.

1,086,029. INDICATING RINGING KEY; E. B. Craft, Hackensack, N. J. App. filed Oct. 4, 1910. The ringing key last operated indicates by its position that it was the last one actuated.

1,086,041. WELDING MACHINE; J. H. Gravell, Philadelphia, Pa. App. filed Jan. 30, 1913. Of the portable type, embodying primary and secondary coils on a core.

1,086,042. WELDING MACHINE; J. H. Gravell, Philadelphia, Pa. App. filed May 17, 1913. Portable, embodying transformer and relatively movable gripping terminals connected to secondary of the transformer.

1,086,080. SNAP SOCKET SHELL; C. D. Platt, Bridgeport, Conn. App. filed July 8, 1908. Interlocking joint between shell and cap.

1,086,083. ELECTRIC BELL; H. E. Reeve, New York, N. Y. App. filed Feb. 12, 1910. Adjustment of the bell with respect to the striker.

1,086,088. MANUFACTURE OF FILAMENTS FOR TUNGSTEN LAMPS; G. P. Scholl, New York, N. Y. App. filed Oct. 6, 1908. Produces a paste or filament consisting of pure tungsten metal and casein.

1,086,096. FIELD-COIL SUPPORT; C. W. Starker, Pittsburgh, Pa. App. filed March 13, 1911. Resilient means serve to exert a separating pressure between the supporting means for the field coils and the frame.

1,086,101. MEANS FOR TRANSFORMING ELECTRICAL ENERGY; E. Weintraub, Schenectady, N. Y. App. filed Feb. 26, 1902. Auxiliary electrode is momentarily brought into electrical connection with one of the main electrodes for starting.

1,086,102. METHOD OF TRANSFORMING ELECTRICAL ENERGY; E. Weintraub, Schenectady, N. Y. App. filed Feb. 26, 1902. Agitates the liquid electrode so as to permit an ionic discharge in starting the arc.

1,086,103. ELECTRIC LAMP; E. Weintraub, Schenectady, N. Y. App. filed Feb. 26, 1902. Magnetic means vary the level of the liquid electrode to control a lamp automatically.

1,086,104. PRODUCING LIGHT BY ELECTRICITY; E. Weintraub, Schenectady, N. Y. App. filed Feb. 26, 1902. Vapor lamp with vaporizable cathode and co-operating anode formed of material containing graphite.

1,086,105. VAPOR ELECTRIC APPARATUS AND METHOD OF OPERATING THE SAME; E. Weintraub, Schenectady, N. Y. App. filed Nov. 17, 1902. Generates discharge between plurality of solid electrodes and thereby initiates discharge between electrodes, one of which is vaporizable.

1,086,106. VAPOR ELECTRIC APPARATUS; E. Weintraub, Schenectady, N. Y. App. filed April 12, 1905. Path from the cathode to an anode reverses in direction.

1,086,107. ELECTRIC LAMP; E. Weintraub, Lynn, Mass. App. filed Feb. 26, 1902. Magnetic means for swinging the lamp to bring the electrodes into contact.

1,086,109. RHEOSTAT; N. Wilkinson, Milwaukee, Wis. App. filed April 17, 1912. Water rheostat in which the insulating members between the electrodes are raised and lowered.

1,086,132. PROCESS FOR THE INDUSTRIAL MANUFACTURE OF ELECTROLYTIC IRON; A. Boucher, Prilly-Chasseur, Switzerland. App. filed March 22, 1913. Effects depolarization of a cathode by dissolved basic iron salts.

1,086,147. ELECTRICAL CONNECTION FOR TELEPHONES AND THE LIKE; J. A. Douglas, Waterloo, Ia. App. filed March 31, 1913. Telephone set is placed in circuit by the mere act of mounting it on its support.

1,086,164. ELECTRIC FURNACE; B. Guthrie and J. P. Karch, Sewickley, Pa. App. filed June 29, 1912. Produces heat by arc in combination with resistance; has electrodes shaped to inclose a crucible.

1,086,165. ELECTRIC HEATING AND COOKING DEVICE; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. Has a large number of readily replaceable heating units especially designed for oven.

1,086,171. PROCESS OF TREATING INCANDESCENT-LAMP FILAMENTS; R. H. Henderson, East Orange, N. J. App. filed Dec. 5, 1910. Subjects the filament while heated in vacuum to an atmosphere of phosphorus.

1,086,185. VAPOR ELECTRIC APPARATUS; O. O. Kruh, Schenectady, N. Y. App. filed Feb. 20, 1904. Alternating-current rectifier which is not subject to arcing between the anodes.

1,086,186. VAPOR ELECTRIC DEVICE; O. O. Kruh, Schenectady, N. Y. App. filed April 15, 1907. Has a shield above the anode and a deflector below the anode and separated from the shield by an annular arc space.

1,086,196. ELECTRIC WHISTLE-BLOWING APPARATUS; F. C. McCaffrey, Burlington, Vt. App. filed Feb. 19, 1913. Embodies a plurality of circuits and a dash-pot for controlling the movement of a solenoid core.

1,086,249. ELECTRIC SWITCH AND LOCKING MEANS THEREFOR; R. H. Vickers, Fayetteville, Ark. App. filed Jan. 3, 1913. Includes a spring-pressed pawl or pawls adapted to sit within recesses formed in a circuit-closing plunger.

1,086,300. RECTIFYING APPARATUS; C. A. Kraus, Newton Highlands, Mass. App. filed Nov. 21, 1910. Eliminates short-circuit arcing in the exhausted container.

1,086,311. ELECTRIC-ARC LAMP FOR SEARCHLIGHTS, PROJECTORS AND THE LIKE; H. Beck, Meiningen, Germany. App. filed Nov. 22, 1913. Employs a high current density to produce a tongue in the negative flame and blows said tongue away from center of the positive electrode by a jet of gas.

1,086,338. INSULATING LINING; C. L. Sherman, Philadelphia, Pa. App. filed June 30, 1913. Elastic compressible socket shell lining with outwardly projecting bead.